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# RECORDS

OF

# OCEANOGRAPHIC WORKS

# IN JAPAN

Compiled by

THE COMMITTEE ON PACIFIC OCEANOGRAPHY

OF

THE NATIONAL RESEARCH COUNCIL OF JAPAN

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# Sedimentation from an Oceanographical View

By

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Tôhoku Imperial University, Sendai, Japan

In the present article I wish to state a few interesting facts that may be considered as data in discussing the depth of sedimentation of fossiliferous strata, mainly from an oceanographical point of view. The data to be used as a working basis comprise the collection of recent Mollusca dredged by the Husa-maru of the Tiba Fisheries Experimental Station at Tateyama-Hôzyô-mati, Tiba prefecture, during the years 1931–1933, from the littoral sea of the Pacific side of Bôsô Peninsula, covering an area stretching from a little north of Tyôsi Peninsula at the north to near the southern end of the promontory of Sirahama. Also a few fossil localities in Bôsô Peninsula are used for comparison with the recent one.

The surveyed area extends from about 34° 38′ to 35° 36′ North latitude, and from about 139° 38′ to 140° 40′ East longitude at the southern part and from 140° 36′ to 141° 21′ East longitude at the northern part. All of the dredge operations and other oceanographical observations were carried out in the shallow littoral sea of the Pacific side of Bôsô Peninsula at depths less than 300 meters.

At the present time the fauna and flora now known from the materials collected by the Husa-maru comprise, Marine Algae already published by the late Dr. K. Okamura, Brachiopoda already published by myself, Ophiuroidea and Echinoidea already published by Mr. S. Nisiyama, and in this report only a partial list of the recent mollusca will be given in the view that another paper will be written as soon as a complete determination of the materials collected by the Husa-maru are finished. The present report lists not only the recent mollusca so far distinguished specifically among the materials, but also the other marine fauna and flora already published in order that the associated fauna of the mollusca may be easily known without searching for them

in other literatures.

The materials of recent, Brachiopoda, Ophiuroidea, Echinoidea and marine Algae as known at present are as follows, with their respective stations and depth in meters:

Station Tateyama, depth not given

*Mactra spectabilis* LISCHKE
*Nuculana gordonis* YOKOYAMA
*Sunetta excavata* HANLEY
*Diadora elaborata* SOWERBY

Station 2, off Mera, north of Tyôsi Peninsula, depth not given

*Mactra spectabilis* LISCHKE
*Siphonalia cassidariaeformis* REEVE
*Ophiomyxa australis* LUTKEN

Station 3, off Tyôsi Peninsula, 13 meters

*Echinarachnius mirabilis* AGASSIZ

Station 4, off Tyôsi Peninsula, 12 meters

*Echinarachnius mirabilis* AGASSIZ

Station 5, off Takano, depth not given

*Mactra sachalinensis* SCHRENCK
*Dentalium vernedei* SOWERBY
*Ophiothrix koreana* DUNCAN
*Goniocidaris mikado* DÖDERLEIN

Station 6, off Tyôsi Peninsula, depth not given

*Mactra spectabilis* LISCHKE
*Taras japonicus* PILSBRY
*Steriocidaris japonica* DÖDERLEIN

Station 8, off Tyôsi Peninsula, depth not given

*Mytilus crassitesta* LISCHKE

Station 9, off Inubo-zaki, 8 meters

*Taras japonicus* PILSBRY
*Xenophora pallidula* REEVE
*Echinarachnius mirabilis* AGASSIZ

Station 10, off Miyagawa, 15.4 meters

*Letterstedtia japonica* HOLMS
*Ecklonia cava* KJELLM.
*Schizymenia dubyi* CHAW.
*Sarcodia montagneana* H. & H.
*Carpomitra cabrae* CLEM.
*Undaria peterseniana* KJELLM.
*Gracilaria textorii* SUR.
*Eruthrocolon meulleri* SOND.

Station 11, south of Osima, 16.4 meters

*Terebratulina japonica* SOWERBY
*Letterstedtia japonica* HOLMS
*Pachydictyon latuiscula* OKAM.
*Undaria peterseniana* KJELLM.
*Erythroglossum pinnatum* OKAM.
*Jolonica nipponica* YABE & HATAI
*Cladophora japonica* YAMADA
*Ecklonia cava* KJELLM.
*Callophyllis crispata* OKAM.

Station 12, off Tyôsi Peninsula, depth not given

*Siliqua pulchella* Dunker
*Dentalium pretiosum* Sowerby
*Siphonalia cassidariaeformis* Reeve

Station 14, off Inubo-zaki, 26 meters

*Cardium bulowi* Rolle
*Glycymeris vestitus* Dunker
*Lutraria maxima* Jonas
*Mactra sachalinensis* Schrenck
*Ophiunephthys vadicola* Matsumoto
*Siliqua pulchella* Dunker
*Pecten laqueatus* Sowerby
*Dentalium weinkauffi* Dunker
*Siphonalia cassidariaeformis* Reeve

Station 15, off Inubo-saki, 40 meters

*Echinocardium cordatum* Pennant

Station 16, off south of Osima, depth not given

*Asteroporpa hadracantha* Clark
*Glyptocidaris crenularis* Agassiz
*Goniocidaris mikado* Döderlein

Station 20, off Inu-waka, 28 meters

*Pictothyris picta* Dillwyn

Station 22, off Nagasaki-hana, 35 meters

*Stegophiura sladeni* Duncan

Station 23, off Iioka, 12 meters

*Mactra sachalinensis* Schrenck
*Mactra spectabilis* Lischke
*Petricola aequistriata* Sowerby
*Taras japonicus* Pilsbry
*Neptunea arthritica* Valenciennes
*Echinarachnius mirabilis* Agassiz

Station, 24 off Iioka, 24 meters

*Ophiothrix marenzelleri* Koehler
*Temnopleurus hardwickii* Gray
*Echinarachinius mirabilis* Agassiz
*Coenopedina mirabilis* Döderlein
*Temnotrema sculptum* Agassiz

Station 25, off Tyôsi Peninsula, 17 meters

*Limopsis multistriata* Forskal
*Mactra sulcataria* Reeve
*Tonna luteostoma* Küster
*Temnopleurus hardwickii* Gray
*Echinocardium cordatum* Pennant
*Mactra spectabilis* Lischke
*Pecten laqueatus* Sowerby
*Stegophiura sladeni* Duncan
*Pseudomaretia alta* Agassiz

Station 26, off Tyôsi Peninsula, 15 meters

*Cancellaria nodulifera* Lamarck
*Siphonalia cassidariaeformis* Reeve
*Amphiura diomedeae* Lutken & Mortensen
*Coenopedina mirabilis* Doderlein
*Tonna luteostoma* Küster
*Umbonium giganteum* Lessen
*Ophiothrix eusteira* Clark
*Echinocardium cordatum* Pennant

Station 27, off Kuriyama-gawa, 17 meters

*Nuculana gordonis* YOKOYAMA
*Echinocardium cordatum* PENNANT
*Fusinus perplexus* A. ADAMS

Station 29, off Kuriyama-gawa, 10 meters

*Echinocardium cordatum* PENNANT

Station 31, off Kobama, depth not given

*Mactra spectabilis* LISCHKE
*Umbonium giganteum* LESSEN

Station 32, off Nabaki, 14 meters

*Pachytictyon coriaceum* HOLMS
*Callophyllis crispata* OKAM.
*Ecklonia cava* KJELLM

Station 33, off Nabaki, 21 meters

*Rhodymenia intricata* OKAM.
*Spyridia elongata* OKAM.
*Hetersiphonia japonica* YENDO
*Rhodymenia cuneifolia* OKAM.
*Amansia japonica* HOLMS.

Station 34, off Miyagawa, 30 meters

*Letterstedtia japonica* HOLMS
*Undaria peterseniana* KJELLM.
*Callophyllis crispata* OKAM.
*Eckolonia cava* KJELLM.
*Geledium subcostatus* OKAM.

Station 37, off Hamazyuku, 31 meters

*Echinocardium cordatum* PENNANT

Station 38, off Iioka, 30 meters

*Lutraria maxima* JONAS

Station 39, off Itinomiya, 44 meters

*Stegophiura sladeni* DUNCAN

Station 40, off Itinomiya, 13 meters

*Sterocidaris japonica* DÖDERLEIN
*Goniocidaris clypeata* DÖDERLEIN

Station 42, off Kobama, 17 meters

*Siliqua pulchella* DUNKER
*Ophiothrix marenzelleri* KOEHLER
*Echinocardium cordatum* PENNANT
*Siphonalia cassidariaeformis* REEVE
*Strongylocentrotus nudus* AGASSIZ

Station 44, off Kobama, 104 meters

*Lucina civica* YOKOYAMA
*Nuculana gordonis* YOKOYAMA
*Fibularia acuta* YOSHIWARA
*Nassarius caelatus* A. ADAMS
*Goniocidaris clypeata* DÖDERLEIN

Station 45, off Arakawa, 23 meters

*Acila insignis* GOULD
*Arca boucardi* JOUSSEAUME
*Pecten nipponensis* KURODA
*Pecten swiftii* BERNARDI

*Cardium becki* REEVE
*Cardium bulowi* ROLLE
*Meiocardia tetragona* ADAMS & REEVE
*Nuculana ramsayi* SMITH
*Lucina acutilineata* CONRAD
*Xenophora tenuis* HIRASE
*Tugalia gigas* MARTIN
*Hemithyris woodwardi* A. ADAMS
*Terebratulina japonica* SOWERBY
*Coptothyris grayi* DAVIDSON
*Dallina raphaelis* DALL
*Laqueus pacificus* HATAI
*Astrodendrum sagamianum* DÖDERLEIN
*Ophiothrix eusteria* CLARK
*Opechinus variabilis* DÖDERLEIN
*Ophiomusium trychnum* CLARK
*Laganum diplorprum* AGASSIZ & CLARK
*Saxidomus purpuratus* SOWERBY
*Spondylus candidus* LAMARCK
*Venus stimpsoni* GOULD
*Lementina imbricata* DUNKER
*Dentalium hungerfordi* PILSBY & SHARP
*Gyrineum perca* PERRY
*Craniscus japonicus* A. ADAMS
*Terebratulina pacifica* YABE & HATAI
*Terebratalia gouldii* DALL
*Campages basilanica* DALL
*Laqueus rubellus* SOWERBY
*Astroceras pergamena* LYMAN
*Euryale dofleini* DÖDERLEIN
*Ophiugymna fulgens*
*Ophiomusium cancellatum* LYMAN
*Laganum fudsiyamana* DÖDERLEIN
*Echinolampas stenopetala* AGASSIZ & CLARK

## Station 48, off Kido, 81 meters

*Cardita cumingiana* DUNKER
*Volva volva* LINNÉ
*Pitar pellucida* LAMARCK
*Stroceras pergamena* LYMAN

## Station 51, off Kido, 5 meters

*Nassarius gemmulatus* LAMARCK
*Peronella rubra* DÖDERLEIN
*Temnotrema rubrum* DÖDERLEIN

## Station 53, off Kido, 177–130 meters

*Cardium becki* REEVE
*Cardita cumingiana* DUNKER
*Macrocallista pacifica* DILLWYN
*Meiocardia tetragona* ADAMS & REEVE
*Pitar pellucida* LAMARCK
*Xenophora tenuis* HIRASE
*Laqueus rubellus* SOWERBY
*Solecurtus divaricatus* LISCHKE
*Limopsis crenata* A. ADAMS
*Taras japonicus* PILSBRY
*Ancillaria albocallosa* LISCHKE
*Trichotropis unicarinata* BRODERIP & SOWERBY
*Xenophora exuta* REEVE

## Station 54, off Kuriyama-gawa, 150 meters

*Xenophora tenuis* HIRASE

## Station 58, off Hiranosinden, 47 meters

*Cucullaea granulosa* JONAS

## Station 61, off Kido, 80 meters

*Cardita cumingiana* DUNKER
*Crassatellites nanus* ADAMS & REEVE
*Spondylus cruentus* LISCHKE
*Crepidula aculeata* GMELIN
*Tonna luteostoma* KÜSTER

## Station 73, off Kido, 90–87 meters

*Crassatellites nanus* Adams & Reeve — *Macrocallista pacifica* Dillwyn

Station 77, off Hiranosinden, 160–110 meters

*Cardita cumingiana* Dunker — *Spondylus cruentus* Lischke
*Limopsis multistriata* Forskal — *Crepidula aculeata* Gmelin
*Pecten laqueatus* Sowerby — *Venus stimpsoni* Gould
*Taras japonicus* Pilsbry

Station 78, off Hiranosinden, 41–33 meters

*Cardium becki* Reeve — *Solecurtus divaricatus* Lischke
*Meiocardia tetragona* Adams & Reeve — *Columbarium pagoda* Lessen
*Xenophora tenuis* Hirase

Station 79, off Hiranosinden, 51–40 meters

*Crassatellites nanus* Adams & Reeve

Station 80, off Hiranosinden, 100–67 meters

*Dentalium vernedei* Sowerby — *Ancillaria albocallosa* Lischke

Station 81, off Hiranosinden, 154–132 meters

*Cardium becki* Reeve — *Xenophora tenuis* Hirase
*Gyrineum perca* Perry

Station 82, off Hiranosinden, 27–24 meters

*Cardium becki* Reeve — *Gyrineum perca* Perry

Station 83, off Hiranosinden, 58–49 meters

*Cardita cumingiana* Dunker — *Spisula bernardi* Pilsbry
*Macrocallista pacifica* Dillwyn — *Venus stimpsoni* Gould
*Pecten laqueatus* Sowerby — *Solen grandis* Dunker
*Protothaca jedoensis* Lischke — *Gyrineum perca* Perry
*Terebratalia coreanica* Adams & Reeve — *Pictothyris picta* Dillwyn

Station 84, off Hiranosinden, 147–130 meters

*Acila insignis* Gould — *Pitar pellucida* Lamarck
*Cardium becki* Reeve — *Ancillaria albocallosa* Lischke
*Meiocardia tetragona* Adams & Reeve — *Xenophora tenuis* Hirase
*Solecurtus divaricatus* Lischke — *Gyrineum perca* Perry
*Nuculana confusa* Hanley — *Craniscus japonicus* A. Adams
*Terebratulina pacifica* Yabe & Hatai — *Terebratulina japonica* Sowerby
*Dallina raphaelis* Dall — *Laqueus quadratus* Yabe & Hatai
*Goniocidaris clypeata* Doderlein — *Opechinus variablis* Döderlein

Of the species of Mollusca listed above, those found in the Pliocene and Pleistocene shell beds of certain localities in Bôsô Peninsula are given in the following list. Of the fossil localities mentioned, Dizôdo, Yabu and Tako-mati belong to the Pliocene in age, Hirayama and

Toyonari are of the Pleistocene. These localities were selected because they yield a rich fauna on the one hand and their geographical positions are favourable for making a comparison with the recent fauna on the other. The localities given for the distribution of the forms represented as fossil are selected because of their fauna being well known.

From the bathymetric ranges of the species represented in the shell-beds it seems that none of the shell beds were deposited in deep water, and all seem to have been laid down in water having a depth less than 300 meters. The faunal assemblage suggests a water depth of around 23 to 150 meters, providing the recent molluscan fauna and their bathymetric ranges as compiled from the data of the Husa-maru may be applied directly to the fossil fauna of the adjoining land.

Although the bottom materials for the stations of the Husa-maru are not known, the chart No. 62, published by the Hydrographic Department of the Imperial Japanese Navay, shows that down to about 10 meters in the region from Tyôsi Peninsula south to Taitô-zaki, consists of sand and shells; and in the same region, down to about 20 meters, the bottom is of sand and shells, fine sand, hard mud: and in depths below 20 meters, the bottom is of sand and shells, rocks, fine sand, and coarse sand with shells. In the region south of Taitô-zaki to Nozima or the southern tip of the Peninsula, the bottom is mainly of sand, fine sand, coarse sand, rocks with mud in the deeper parts. The bottom has but a slight inclination in the northern part above mentioned, but in the southern part the bottom is rather steeply inclined.

The marine animals collected by the Husa-maru agree well with the bottom materials plotted on the chart of the Hydrographic Department, and even without knowledge of the bottom materials, it appears that the bottom materials could be approximately estimated. Another method of estimating the bottom materials of regions in which the bottom materials has not been plotted, is by taking an analyses of the kind of fossil shells found in the kind of sediments and applying the results to the stations from where similar or identical shells were collected.

Providing deposition of the fossil localities above mentioned were of nearly similar depths, the question arises as to whether there was any change in sea water temperature, between the seas of the Pleistocene and those of the upper Pliocene. From the geographic distributions

| Recent Species Found in Some Pliocene and Pleistocene Deposits of Bôsô Peninsula | Fossil Localites in Bôsô Peninsula | | | | | | Geographical Distribution | | | | | | Bathymetric Range in Waters of Pacific Side of Bôsô Peninsula (in meters) Husa-maru |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tako-mati[2] | Toyonari[4] | Hirayama[3] | Dizodo[1] | Yabu[1] | Oyari[5] | Zusi, Sagami | Miyazaki prefecture[6] | Hyogo prefecture | Hukui prefecture[7] | Yamagata prefecture[8] | Hukusima prefecture[9] | |
| *Acila insignis* GOULD | · | · | · | · | × | · | × | · | · | · | · | · | 23–147 |
| *Arca boucardi* JOUSSEAUME | × | · | · | × | · | · | × | × | × | × | × | × | 0–23 |
| *A. nipponensis* PILSBRY | × | · | · | × | · | · | × | · | · | · | · | · | 0–17 |
| *Cardium bulowi* ROLLE | · | × | · | · | · | · | × | · | × | × | · | · | 10–23 |
| *Crassatellites nanus* ADAMS & REEVE | · | · | × | · | · | · | × | × | × | × | · | · | 0–90 |
| *Glycymeris vestitus* DUNKER | × | · | · | × | × | · | × | × | × | × | · | · | 0–17 |
| *Limposis crenata* A. ADAMS | · | · | · | × | × | · | × | · | · | × | · | · | 130–177 |
| *L. multistriata* FORSKAL | × | × | · | · | × | · | × | · | × | × | · | · | 17–160 |
| *Macrocallista pacifica* DILLWYN | · | · | · | × | · | · | × | × | · | × | · | · | 17–130 |
| *Mactra sachalinensis* SCHRENCK | × | · | × | · | · | × | × | × | × | × | × | × | 0–177 |
| *M. sulcataria* REEVE | · | · | × | × | × | × | · | · | × | · | × | × | 0–17 |
| *Lutraria maxima* JONAS | × | × | × | × | × | × | × | × | · | × | · | × | 0–17 |
| *Nuculana confusa* HANLEY | · | × | · | · | · | · | × | × | · | · | · | · | 0–140 |
| *N. gordonis* YOKOYAMA | · | · | · | · | × | · | · | · | · | × | · | · | 17–104 |
| *Pecten irregularis* SOWERBY | × | · | · | × | · | · | × | × | · | × | · | · | 0–147 |
| *P. nipponensis* KURODA | × | × | · | · | × | · | × | × | × | × | × | × | 0–23 |
| *P. laqueatus* SOWERBY | × | × | × | × | × | × | × | × | × | × | × | × | 0–160 |
| *P. plica* LINNÉ | × | · | · | · | · | · | × | × | × | × | · | · | 0–58 |
| *P. swiftii* BERNARDI | × | · | · | · | · | · | · | · | · | · | · | × | (fossil?) |
| *Petricola aequistriata* SOWERBY | × | · | × | · | · | · | × | × | × | · | · | × | 0–12 |
| *Protothaca jedoensis* LISCHKE | × | × | · | × | · | · | × | × | × | × | × | × | 0–58 |
| *Pseudogrammatodon dalli* SMITH | × | · | · | × | · | · | × | · | · | · | · | × | 0–23 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Saxidomus purpuratus* SOWERBY | × | · | × | × | × | × | × | · | × | · | · | × | 0–23 |
| *Siliqua pulchella* DUNKER | × | · | × | · | · | · | × | × | × | × | × | × | 0–17 |
| *Spisula bernardi* PILSBRY | · | · | · | × | · | · | · | · | × | × | · | · | 49–58 |
| *Taras japonicus* PILSBRY | × | · | · | · | · | · | × | · | × | · | · | × | 0–177 |
| *Venus stimpsoni* GOULD | × | · | × | × | × | × | · | · | · | · | · | × | (fossil?) |
| *Dentalium pretiosum* SOWERBY | · | · | × | · | · | × | · | · | · | × | · | · | 0–17 |
| *D. weinkauffi* DUNKER | × | × | × | × | × | × | · | · | × | × | · | · | 0–17 |
| *Cancellaria nodulifera* MARTIN | × | · | · | · | × | · | × | × | × | · | · | × | 0–16 |
| *Fusinus perplexus* A. ADAMS | · | × | · | × | × | · | × | × | × | × | × | × | 0–20 |
| *Lementina imbricata* DUNKER | · | × | · | · | × | × | × | × | × | × | × | × | 0–23 |
| *Nassarius caelatus* A. ADAMS | · | × | · | · | · | · | × | · | × | × | · | · | 0–104 |
| *N. gemmulatus* LAMARCK | × | × | · | · | · | · | × | × | × | × | · | · | 0–5 |
| *Neptunea arthritica* VALENCIENNES | × | · | · | · | · | × | · | · | · | · | · | × | 0–12 |
| *Siphonalia cassidariaeformis* REEVE | × | · | · | × | × | · | · | × | × | · | · | · | 0–17 |
| *Tonna luteostoma* KÜSTER | × | × | × | · | × | × | × | × | × | × | × | × | 16–80 |
| *Umbonium giganteum* LESSEN | · | · | × | · | · | · | × | × | × | · | · | × | 0–16 |
| *Xenophora tenuis* HIRASE | · | · | · | · | × | × | × | · | · | · | · | · | 23–177 |




1) K. SAKAKURA, Stratigraphie du bassin d'Obitugawa, Préfecture de Tiba, Japon, Jour. Geol. Soc. Jap., Vol. 42, pp. 685–712, 753–784, 1935.
2) K. SUZUKI and F. TAKAI, Fossiliferous Beds in the Vicinity of Tako-mati, Tiba Prefecture, Jour. Geol. Soc. Jap., Vol. 42, pp. 1–35, 1935.
3) T. OINOMIKADO, K. SUZUKI, K. SAKAKURA and N. IKEBE, Fossiliferous Beds of Hirayama, Tiba Prefecture, Chikyu, Vol. 26, No. 4, pp. 237–246, 1936.
4) N. IKEBE, Fossiliferous Beds of Toyonari, Tiba Prefecture, Venus, Vol. 6, No. 4, pp. 189–205, 1936.
5) N. IKEBE, Fossiliferous Beds of Oyari, Tiba Prefecture, Chikyu, Vol. 26, No. 4, pp. 231–236, 1936.
6) T. KURODA, Catalogue of Marine Shells of Miyazaki Prefecture, 1935.
7) T. KURODA, Catalogue of Marine Shells of Hukui Prefecture, 1933.
8) S. NOMURA and N. ZINBO, List of Marine Shells of Yamagata Prefecture, 1936.
9) S. NOMURA and H. TSUNODA, List of Marine Shells of Onahama, Hukusima Prefecture, 1933.
10) S. NOMURA and K. HATAI, Zoological Provinces in Japanese Seas, Bull. Biogeogr. Soc. Jap., Vol. 6, No. 21, pp. 207–214, 1936.

of the fossil shells known from the Oyari and Hirayama beds, in the present seas of Japan, it appears that they were deposited in a sea having a water temperature lower than that of the recent seas adjacent to Bôsô Peninsula.

There seems to be a close relation existing between the recent molluscs and brachiopods above listed to those now found embedded in the Neogene deposits of the Kwantô region as well as elsewhere, and in the following I shall mainly discuss the relation of the preservation of coloration in fossils to the conditions now observable among the recent molluscan and brachiopoda faunules.

It has long been known that invertebrate fossils often retain their color markings. The color markings may be preserved as radiating, divaricating or concentric lines or bands, in the forms of dots or blotches, in zigzag pattern or in some other patterns. In fossils of young geological age, the original colors are more frequently preserved than in those of earlier ages. In general, the color of Palaeozoic fossils are usually indicated by only varying shades of dark and light. So far as known through literature, the invertebrate fossils retaining their color markings are of the following groups: trilobites, crinoids, pelecypods, gastropods, cephalopods and brachiopods.

The nature of the pigment in the shells of molluscs, brachiopods and crinoids is not well known even in the recent forms. The dark pigment is generally accepted as belonging to the group of melanin pigments which, according to Oppenheim (1918), cause the dark coloring of various shells of mollusca, and since they are not soluble in alcohol, water or ether and even resist rather strong acids, they are little destructible.

According to Foerste (1920) the color banding consisted in most cases of various tints of brown; this he beleives, suggests that all these color bands belong to a melanin-like pigment in chemical association with iron, as shown by his experiments in the Devonian brachiopod, *Rhynchonella pugnus*, Em. Kayser.

Foerste in another paper (1930) gives the following statement in regard to this question: "Most colors of shells are not visible during the life of the animal. In many shells, the prismatic layers, which carries the color markings at or immediately beneath its surface, is covered by a horny or conchiolin, which conceals these colors during the life of the animal. In those not covered by a horny layer the prismatic layer, with its color markings, is concealed by reflections of the mantle.

Of course, the horny layer or the mantle itself may show colors, but they are not the colors retained by shells in their fossil forms, and therefore have nothing to do with the present study''.

Newton (190) held that in recent mollusca shells coloration usually exists beneath the epidermis and its secretion is affected by the border of the mantle. According to Forbes (1840–44), such secretion depends largely upon the action of light, thus, shells found in shallow water would be, as a rule, more beautifully colored than those obtained from considerable depths.

According to Miller (1922) who made studies on the variation on the shell of *Teredo navalis* in San Francisco Bay, the color in that species ''lies entirely in the periostracum, which may be scraped off, leaving the shell perfectly white. This would suggest that the thickness of the periostracum is at least a factor in producing depth of color. It has been stated above that the shells from the upper bay exhibit a thicker and rougher epidermis; it is natural therefore that these shells should have the deepest color, while those from the lower bay would be lighter, owing to the white prismatic layer showing through the thinner epidermis.

That coloration is, however, in considerable measure directly dependent on immediate factors of environment, independent of the thickness of the periostracum, becomes evident from certain types of what we may term ''accidental'' coloration that have been occasionally observed.

In two different instances we have found that a nail driven into a redwood timber below water line has produced an area of black discoloration (ferric tannate) through the action on the iron of the tannic acid in the wood. Teredos were working successfully in this discolored area, but their bodies and shells were deeply stained with blue. Teredos working elsewhere in the same piece of wood were not so colored.''

This statement given by Miller well explains the case of *Teredo navalis* Linnaeus, in which the color is found on the outer but not inner part of the shell. However, in cases like *Saxidomus purpuratus* Sowerby, the coloration is dark purple, and only on the inner part of the shell. No such color is found on the outer part of the shell. Furthermore, for this case another explanation must be sought for. Also if Forbe's explanation that the secretion of color depends largely upon the action of light, and Foerste's statement that there evidently

is an intimate connection between the presence of color markings on shells and their access to light during the life of the animal are true, then, the coloration of some gastropods may be explained but there is a greater question at hand. From those two explanations it seems that all mollusks found in the same depth and ecological conditions should show nearly similar color markings, but this is not the case. Mollusks in the same ecological conditions even in the same species, such as *Meretrix meretrix* and *Paphia philippinarum* which almost always live burried in either muddy or sandy bottoms. Also beautifully colored shells as *Dentalium formosum* lives burried in the muddy or sandy bottom of considerable depth; such forms are difficult to explain for the fact that their access to light is very poor if not entirely wanting. It is questionable whether light alone is a governing factor?

Brachiopods living above the sea bottom are attached to some foreign material by a peduncle; their coloration may be explained in part by the method of FORBES and FOERSTE. We are unaware of the degree that light penetrates into mud if it does at all, but it seems to us that there are many other factors in need of consideration in regard to the present question.

The ecological conditions of the animal are to be known. The question arises whether or not the shell is liable to change its color with a change in environment. Change of temperature, difference of salinity, associated fauna and flora, kind of food digested by the animals, strength or variability of the oceanic currents, and physiology of the animal etc., may be factors in need of consideration. The access of light alone does not seem sufficient in producing color markings, as mollusks in similar conditions are frequently found with not only different colors but some are at the same time and place found to be without such bright colors as shown by those in association. And also those molluscs living above the sea bottom sometimes do not exhibit coloration as brilliant as those living in the mud or sand of the sea-bottom at the same place. The coloration of molluscs and brachiopods may have originated at first merely by the effect of light, then modified by several ecological factors mentioned above, and may even be taken to be an evolutionary trend shown in animal through heredity.

Whatever be the answer to this question, it is certain that there remains much more room for further researches along this line, biologically, ecologically, physiologically, chemically, and even geologically.

In dealing with the preservation of color in a Trilobite, *Anomocare*

*vittata* RAYMOND, RAYMOND (1922), gives the following statement:

"Pelagic Crustacea usually have pigmentless tests, and owe their brilliant colorations to chromatophores, circulating fluids, or the structure of their shell. The present specimen (*Anomocare vittata*), as was to be expected, falls in with the group in the shallow water.

The shells of the branchiopods and copepods do not commonly contain pigments but among the amphipods and isopods are to be seen some patterns which are similar to the one on this trilobite. According to NEWBIGIN, red lipochromes are the dominant pigments in the Crustacea, as in the deep sea crustaceans. When much lime is present in the shell an orange tint is often produced. This being the case, and the tests of many trilobites being rather thick and calcareous, it may be possible to predict various shades of orange in coloration. With an appropriate organic base the red lipochrome apparently produces green and brown. With the aid of these general principles and applying previously gained knowledge of the probable habits of any particular form, it may be possible to approximate somewhat reasonable to the actual appearance of one of these animals in nature."

RAYMOND's interesting statement may well explain the coloration in recent forms of crustaceans, amphipods, isopods, and branchiopods. But in the case of molluscs and brachiopods, it is very questionable whether the nature of coloration is the same; this may also be said for the trilobites, because their true relation to recent forms is unknown. Furthermore, it is known that recent forms of crustacea and etc., possess tests which are colored by a phenomena different from that of the molluscs and brachiopods. Whether the color of the trilobites may be explained by the mode of coloration presented in recent forms of crustacea may also be questionable, since their colors might be more easily dissolved in acids or other liquids than those of the molluscs and brachiopods. If they are more easily dissolved as is suspected then it follows that the coloration of the trilobites must be attributed to a phenomenon similar to that of the molluscs.

Several examples of the retention of color markings in fossils so far recorded are listed below.

RUEDEMANN (1921) made studies on several primitive cephalopods retaining their color markings. From the more well preserved color markings he attempted to explain the mode of life that they led. In *Orthoceras* (*Geisonoceras*) *tenuitextum* (HALL) from the Trenton limestone of New York, *O.* (*Protokionoceras*) *trusitum* CLARKE and

RUEDEMANN from the Guelph limestone at Rochester and *Actinoceras tenuifilum* (HALL) from the Black River (Watertown) limestone of New York and Canada, he remarked that the color markings are found only on one side of the shell, its dorsal side.

This is explained by RUEDEMANN in the following way:

"We see in the phenomenon of the coloring of the shells on one side only direct evidence that the species in question was given either to crawling on the bottom of the sea or to swimming in a horizontal position, either of which habits would have developed a differential coloring on the dorsal and ventral sides. It seems improbable that the long and straight cones could have been carried horizontally in swimming, especially since the creatures, like their descendants, would have swum backward, and thus expose the delicate shell to frequent collisions and fracturing.

There is evidence that supports the view that the conchs, bouyed up by gas in the air chambers, were lightly dragged over the soft mud by the sluggish animals. One of these shells on closer inspection turn out to be no regular cones, but to be gently curved, so that one side with the color bands is slightly convex, while the other (ventral) side is straight or even a little concave.

Another observation that corroborates the explanation here given is that specimens of the same species found in the Utica shale are sometimes overgrown with a bryozoan (*Spatiopora lineata* ULRICH, var. *compacta*), whose zoarium begins to grow near the apex and thence extends forward toward the aperture of the shell, also on one side of the shell only. If the bryozoan had attached itself after the death of the cephalopod, it would hardly have grown pari passu with the shell."

Such forms, RUEDEMANN explains of having taken to a crawling life. However, there are also Silurian species of *Cyrtoceras* with transverse zigzag color bands passing entirely around the conch. These according to BARRANDE (1886) have short curved shells. Both *Orthoceras* and *Cyrtoceras* are said to be crawling forms, the former dragging the conch and the latters carrying it in oblique or nearly straight or upright position. Thus, according to RUEDEMANN, color markings are found only on the dorsal side and due to the "differentiation between dorsal and ventral color markings is lost in the breviconic forms, both sides being equally exposed to light."

KNIGHT (1932) gives good illustrations of a Pennsylvanian gasteropod known as *Meekospira peracuta* (MEEK and WORTHEN),

showing color patterns which consists of two narrow revolving dark bands. Traces of coloration are said to be present in *Actaeonina minuta* (STEVENS), also from the Pennsylvanian.

BATHER (1843) reports the presence of color markings in several Gotland crinoids, *Cyathocrinus ramosus* and *C. longimanus*. These are stated to be of a rich brown color. According to his report, some species of *Thyranocrinus* are of a deep brown and sometimes almost black, while a dark color seems to be characteristic of the genus *Dimerocrinus*, both are from the Wenlock limestone. In the lower Carboniferous rocks of North America, certain species are always distinguished by their color.

BATHER states that, "Sometimes, on the other hand, the colour appears to be concentrated in particular regions of the crinoid, as the beautiful purple of the *Apiocrinus* root, which, however, is occasionally found in the upper columnals and in the crown."

RAYMOND (1922) reports the occurrence of a species of trilobite, *Anomocare vittata* RAYMOND, retaining color markings from the Cambrian rocks of Cherokee County, Alabama.

The color pattern retained in this trilobite is taken by RAYMOND to represent the original coloration. He gives the following statement in this concern, "These markings probably do not retain the original colors, which may well have been brilliant. It is interesting to note that the patterns is such that the animal would not easily have been detected if viewed from above were the surface of the water gently agitated, and also suggests patches or shadows of sea weeds."

He has also (RAYMOND, 1906) reported the occurrence of a lower Ordovician gasteropod, *Stroparollina harpa* HUDSON, from the Chazy limestone at Valcour Island, New York. The body is light yellow in color, a narrow brownish band is found near the top of the body whorl and a yellow band below and, at the middle of the whorl, another brownish-gray band still deeper than the one on the top is found. Below this principal band is stated to be another light yellow band, which becomes orange at the umbilicus.

KEYES (1890), records the presence of color in *Trachydomia wheeleri* SWALLOW, from the Coal Measures of Illinois, *Patula strigosa* GOULD and *alternata* Say, from the loess (post-pliocene) deposits of the Upper Mississippi Valley.

FOORD (1888, 1891), enumerates the following species with color markings, namely, *Orthoceras annulatum* SOWERBY, (Wenlock lime-

stone), *O. unguis* PHILIPS (Carboniferous limestone), *Cyrtoceras depressum* GOLDFUSS (*Stringocephalen, Goniatiten*-Kalk, Iberger-Kalk, middle-upper Devonian), *Cyrtoceras* (*Meloceras*) *expadeus* BARRANDE (Etage E), *C.*(*M.*) *parvulum* BARRANDE (Etage E), *C.*(*M.*) *acus* DE KONINCK (Carboniferous limestone), *Coelonautilus paucicarinatus* FOORD (Carboniferous limestone), *C. pinguis* DE KONINCK (Carboniferous limestone), *Aturia aturi* BASTEROT (London clay).

The FENTONS (1924) have recorded the occurrence of two brachiopods, *Cranaenella navicella* (HALL), and *C. calvini* (HALL and WHITFIELD), from the Hackberry Stage of Iowa. Both of these forms retain their color, the former is brown and olive-brown with purplish-brown mottelings, the latter is the same as the former except for touches of purple and chocolate.

FISCHER (1925), states the presence of color markings in the brachiopod *Coenothyris vulgaris* VON SCHLOTHEIM, a Triassic species. According to his accompanying figures (pl. 1, figs. A–L, pl. 2, figs. A–F, pl. 3, figs. 1–9), the radial color is almost as beautifully preserved as recent specimens. He has compared the coloration of his fossil specimens to the recent Japanese *Terebratella rubella* SOWERBY (now known as *Laqueus rubellus*). The figures and coloration of the species which FISCHER states to be *Terebratella blanfordi* DUNKER appears to be identical with *Laqueus rubellus* just mentioned. FISCHER believes that the color retained by the fossil *Coenothyris vulgaris* to be that of when it lived. We can agree in this point and also may state that brachiopods in fossil state with such beautiful coloration are unknown, even among the Pliocene, Plio-Pleistocene fossils of southern Japan, such marvelous preservation of color markings are totally unknown.

Besides this brachiopod, he also mentioned the occurrence of such fossils as, *Semipecten* (*Pleuronectites*) *laevigatus* v. SCHLOTH., its varieties *zonata* FISCHER and *derognati* FISCHER, *Avicula lineata* GOLDFUSS, *Avicula substriata* CREDNER and ? *Lima striata* v. SCHLOTH. are also of interest.

The two varities of the *Semipecten* mentioned above are distinguished from each other by their color markings, i.e., concentric or radial. The concentric ones are best preserved.

In another paper FISCHER (1925) mentioned the presence of color patterns in several species of fossil *Nerita, N. ponderosa* PIETTE, *N. gea* D'ORBIGNY, *N. delumbata* PIETTE and *N. millepunctata* R. FISCHER. In these forms the coloration is concentric.

Greger (1914), mentions the occurrence of a brachiopod, *Craneana morsii* Greger retaining the color markings, it came from the Craghead Creek shales (middle Devonic) of central Missouri. Beside the following are mentioned, namely, *Lingula* sp., Rowley from the Grassy Creek shale (upper Devonic) of Pike County, Missouri; *Dielasma calvini* H. and W., from the upper beds of Craghead Creek shale, Missouri; *Orbiculoidea humilis* Hall from the Hamilton shales of the Canadiagua Lake region of New York; *Crania modesta* W. and H., from the Cherokee shale (Pennsylvanian) of Central Missouri. *Lingula* sp., shows dark blue bands concentrically arranged. *Dielasma calvini* with rays of color. *Orbiculoidea humilis* with alternating concentric bands of light greenish horn and dark chestnut brown. *Crania modesta* shows dark blue or is slate-colored. Another form mentioned by Greger is *Discinisca lugubris* Conrad, from the Choptank Formation (Miocene) of Maryland. Greger states that all the specimens he examined are blue-black in color except one in which faint concentric bands were present.

Dr. Yokoyama has recorded the occurrence of numerous pelecypod and gastropod shells retaining their original coloration; since his papers are numerous and his remarks on the retained coloration is found mostly in the discriptive parts of his works, the readers are referred to his papers which are given in the bibliography. In the Kwantô region, the fossils preserving best their original coloration are probably those from the Coral Bed of Awa, the Upper Musasino Formation (Pleistocene), and the Lower Musasino Formation (Pliocene) both of which are widely distributed in the Kwantô region. Even in the region of Northeastern Honsyû, Japan, fossils retaining their original coloration are frequently met with.

Retention of color in fossil brachiopods besides those mentioned by Dr. Yokoyama are those enumerated by Prof. H. Yabe. The latter author mentioned the occurrence of *Pictothyris hanzawai* Yabe from the Ryûkyû limestone, a limestone formation of Lowest Pleistocene age.

Nomura and Zinbô (1934), figure the following species from the Lower Pleistocene Ryûkyû limestone of Kikai-zima, Ryûkyû group, *Triphora solitaria*, *Heliacus dilectus*, *Liotia pseudodiscoidea*, and *Eglisia tricainata*. According to those authors, "Some appear quite fresh and are hardly distinguishable from those strewn along the present sea shore".

It is generally known that marine shell-bearing molluscs inhabiting

northern waters are, as a rule, much less brilliantly colored than those living in tropical or subtropical waters. In fact, probably the colored northern forms worthy of mention may belong only to the following genera, *Mactra, Meterix, Gomphina, Paphia,* and *Sanguinolaria* etc., among the bivalves and among the univalves the following may belong here, *Calliostoma, Cellana, Leptothyra, Cantharidella, Mitrella,* and etc. Even in such colored shells, the majority if not all are dull in color compared to southern forms which present many kinds of varied color patterns.

Thus the relation existing between coloration and latitude in marine shells may be stated as follows. In high latitudes where the water is cold and the temperature more or less uniform, the coloration is generally dull when present or either without beautiful patterns; however, with the lowering of latitude or rising of temperature such as found in tropical or subtropical waters, color patterns become more common, of varied kinds and their degree of brilliancy more intense. This may perhaps be largely due to the intensity of light.

Although coloration and latitude may be related as just mentioned it is difficult to find the relation existing between coloration to latitude and depth.

According to KURODA and KIKUCHI (1933), dredge operation in Toyama Bay at a depth of 80–600 meters some 63 times, gave the following results, "(1) In the tidal zone of the western shore, especially in the vicinity of Nanao Bay, there live, in the soft calcareous sandy rocks, several species of tropic or subtropic boring bivalves, such as *Botula cinnamonea, Coralliophaga coralliophaga* and *Aspidopholas yoshimurai,* etc. (1 b). From the low tide mark down to several meters depth, there occur most of littoral species which are very common in the southern and western coasts of Honsyû, Sikoku and Kyûsyû. (2) On the bottom next the former in depth, up to 100 meters, are sublittoral species similar to those of the similar depth in the southern coast of Honsyû, like Sagami and Kii. The representatives of this zone, for example, are *Turcica imperialis, Turcicula crumpii, Glycymeris rotunda, Chlamys vesiculosa, Siphonalia spadicea,* etc. (3) On the bottom deeper than 300 meters the species above mentioned are no more found, but the genuine boreal fauna such as several species of *Buccinum, Neptunea* (=*Chrysodomus*), *Plicifusus,* etc."

The boreal fauna mentioned by KURODA and KIKUCHI in the above lines, comprise, according to TERAMACHI (1933), the following forms,

namely, *Buccinum bayani* (Jousseaume), *B. tenuissimum* Kuroda, *B. rossicum tsuboi* Kuroda, *Neptunea constricta* (Dall), *Plicifusus aurantius* Dall, and *P. wakasanaus* Dall.

We have in our possession a lot of shells dredged from the shallow waters (16–250 meters) of the eastern side of Bôsô Peninsula, Central Japan, by the Tiba Fisheries Station at Tateyama in Tiba prefecture. Some of them are beautifully colored, the pretty ones were procured from depths ranging between 12 and 150 meters. Nearly all of the species are found in the tidal or littoral zone. The beautifully colored ones belong to such genera as, *Pecten, Venus, Spondylus, Cardium, Tellina, Glycymeris, Dentalium,* among the pelecypods and scaphopods, and *Umbonium, Calliostoma, Tonna, Nassarius, Columbella, Cypraea* and *Conus* among the gastropods. The depth and its fauna corresponds to zone number (2) of Kuroda and Kikuchi referred to above.

The marine shells collected from the coast of Bôsô Peninsula, Tiba prefecture are much more varied both in coloration and species compared to those collected from Matusima Bay, Miyagi prefecture. The dividing or boundary between northern and southern (or western) forms of marine shells may be somewhere near Onahama Bay, Hukusima prefecture. The molluscan fauna of Onahama Bay has already been dealt with in full by Nomura and Tsunoda (1933).

According to Nomura and Hatai (1935), the shells thrown up on the beach by the disastrous 'Sanriku Tunami' of March 3rd 1933, are from a depth of approximately 10 meters. In this report it has been stated that, "although the magnitude of the 'Tunami' be great, its digging and shearing power is restricted to the littoral zone close to the shore line and is roughly estimated beyond the depth of 10 meters". And also that "pelagic forms are totally absent", is another interesting feature. Among the species figured in their report, *Cypraea japonica* Schilder, *Calliostoma cecillei* (Philippi), and *Natica figurata* Sowerby are more likely to be the beautifully colored shells for northern shells.

According to Forbes (after Newton, 1907), "well defined patterns were, with very few and slight exceptions, presented only by testacea inhabiting the littoral, circum-littoral, and median zones. In the Mediterranean only one in eighteen of the shells taken from below 100 fathoms exhibited any markings of colour, and even the few that did were questionably inhabitants of those depths. Between 35 and 55 fathoms the proportion of marked to plain shells was rather less than one in three, and between the sea-margin and 2 fathoms the

striped or mottled species exceed one half of the total number''.

Foerste (1930) in regard to color marking states that ''At greater depths the colors tend to become uniform over the entire surface of the shell, so that color patterns disappear. Moreover, at these depths the variety of colors is restricted more and more to various shades of dull red or of reddish brown''.

Consequently, it appears that beautifully colored shells are more common in shallow water than in deep water and flourish luxuriantly in warm waters rather than in cold.

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## Bibliography referred to

Abe, N.
1934. Ecological Observations on *Batillaria multiformis* (Lischke), ibid., Vol. 8, No. 4, pp. 383–398.

Barrande, J.
1866. System Silurien de la Boheme, Vol. 2, pl. 155, figs. 6, 7; pl. 208, fig. 21; pl. 240, fig. 11.

Bather, F. A.
1892. British Fossil Crinoids, Ann. Mag. Nat. Hist., Ser. 6, Vol. 9, p. 215.
1893. The Crinoids of Gotland, Pt. 1, The Crinoidea Inadunta, Kongl. Svenska. Vetenskops-Akad. Haldl., Bd. 25, No. 2, p. 151.

Fenton, C. L.
1924. The Stratigraphy and Fauna of the Hackberry Stage of the Upper Devonian, pp. 132, 133, pl. 25, figs. 18–22, 23–25.
1931. Oceanography Side of Palaeontology, Pan-Amer. Geologist, Vol. 56, pp. 81–85.

Fischer, P.
1887. Manual de Conchyliologie et de Palaeontologie, fasc. 1, pp. 26–27.

Fischer, P. H.
1925. La Persistance Des Couleurs Parmi Les Fossils Du Trias Moyen, Journ. Conchyl., Vol. 69, pp. 5–12.
1925. Disposition Des Ornements Colours Chez Quelques *Nerita* Du Bathonien De L'Aisne, ibid., Vol. 69, pp. 131–134, 4 textfigs.

Foerste, Aug. F.

1920. The Kimmswick and Plattin limestone of Northeastern Missouri, Denison Univ. Bull. Sci. Lab., Vol. 19, p. 175 (after Ruedemann, 1921, p. 84).
1930. The Color Patterns of Fossil Cephalopoda and Brachiopods, with notes on Gasteropods and Pelecypods, Contri. Mus. Palaeont. Univ. Michigan, Vol. 3, No. 6, pp. 109–150, p pls..

Foord, A. H.
1888–97. Catalogue of the Fossil Cephalopoda in the British Museum, Pt. 1, pp. 116, 266, 292, 297, 308, (1888); Pt. 2, pp. 116, 351, (1891); Pt. 3, p. 292, (1897).

Grabau, A. W.
1932. Principles of Stratigraphy, pp. 1015–1016.

Greger, D. K.
1914. On the Retention of the Original Color Ornamentation in Fossil Brachiopods, Nautilus, Vol. 28, No. 8, pp. 93–95.

Goldring, W.
1929. Preservation of Original Color and Form, Handbook of Palaeontology, New York State Museum, Handbook 9, pp. 45–48.

Hayasaka, I.
1922. On Some Tertiary Brachiopods from Japan, Sci. Rep. Tôhoku Imp. Univ. Sendai, Ser. 2, Geol., Vol. 6, No. 2, p. 150.

Jeffreys, J. G.
1904. British Conchology, Vol. 1, pp. Xl Viii–1.

Kayser, E.
1871. Notiz über *Rhynchonella pugnus* mit Farbenspuren aus dem Eiflen Kalk, (after Ruedemann, 1921, p. 84).

Keyes, C. R.
1890. Preservation of Color in Fossil Shells, Nautilus, Vol. 4, No. 3, pp. 30–31.

Knight, J. B.
1929. Some Pennsylvanian Gàstropods and a Pelecypod Showing Color Marking, Bull. Geol. Soc. Amer., Vol. 40, pp. 212–213.
1932. The Gastropods of the St. Louis, Missouri, Pennsylvanian Outlier; IV, The Pseudomelaniidae, Jour. Palaeont., Vol. 6, No. 2, p. 196, pl. 27, fig. 2 g, p. 198, pl. 28, figs. 2 a–b, 3 a–p.

Kuroda, T., and Kikuchi, K.
1933. Studies on the Molluscan Fauna of Toyama Bay, The Venus, Vol. 4, No. 1, pp. 1–14, 1 pl.

Miller, R. C.
1922. Variations in the Shell of *Teredo navalis* in San Francisco Bay, Univ. Calif. Publ. Zool., Vol. 22, No. 2, pp. 293–328, pl. 13–17, 6 textfigs.

Newton, R. B.
1907. Relics of Coloration in Fossil Shells, Proc. Malacological Soc. Vol. 7, pt. 5, pp. 280–292, pl. 24.

Nomura, E.
1926. The Influence of Coastal Waves on the Shell Development in *Littorina sitchana* Phil., Sci. Rep. Tôhoku Imp. Univ. Sendai, Ser. 4, Biol., Vol. 2, No. 1, pp. 53–55.
1928. On the Local Variation in some Littoral Gastropods, ibid., Vol. 3, No. 3, Fasc. 1, pp. 249, 258.

NOMURA, S.
1932. Mollusca from the Raised Beach Deposits of the Kwanto Region, Sci. Rep. Tôhoku Imp. Univ. Sendai, Ser. 2, Geol., Vol. 15, No. 3.
1933. Catalogue of the Tertiary and Quatery Mollusca from the Island of Taiwan (Formosa) in the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan, ibid., Vol. 16, No. 1.
NOMURA, S., and HATAI, K.
1935. Catalogue of the Shell-bearing Mollusca Collected from the Kesen and Motoyosi Districts, Northeast Honsyû, Japan, immediately after the Sanriku Tunami, March 3, 1933, with Descriptions of Five New Species, Saitô Hô-on Kai Mus. Res. Bull. No. 5, pp. 1–47, 2 pl.
NOMURA, S., and TSUNODA, H.
1933. The Recent Mollusca from Onahama Bay, Hukusima prefecture, Saitô Hô-on Kai Habutukwan Tokusyûgô (in Japanese), No. 3, 19, pp.
NOMURA, S., and ZINBÔ, N.
1934. Marine Mollusca from the "Ryûkyû Limestone" of Kikai-zima, Ryûkyû Group, Sci. Rep. Tôhoku Imp. Univ. Sendai, Ser. 2, Geol., Vol. 16, No. 2.
OPPENHEIM, B.
1918. Ueber die Erhaltung der Färbung bei fossilen Molluskenschalen, Centralbl. f. Min. u. Palaeont., Jahrb. 1918, p. 368.
ORBIGNY, A.
1850. Palaeontologie francaise, terraine jurassique, gasteropodes, p. 56, pl. 244, figs. 4–5.
PILSBRY, H. A.
1916. The Sessile Barnacles (Cirripedia) Contained in the Collection of the United States National Museum, Bull. U. S. Nat. Mus., No. 93, p. 141, pl. 36, figs. 1, 2, 2 a.
RAYMOND, P. R.
1906. An Ordovician Gastropod Retaining Color Markings, Nautilus, Vol. 19, No. 9, pp. 101–102, 1 textfig.
1922. A Trilobite Retaining Color-Markings, Amer. Jour. Sci. Ser. 5, Vol. 4, pp. 461–464, 1 textfig.
RUEDEMANN, R.
1921. On Color Bands in *Orthoceras*, Palaeont. Contri. New York State Mus. Bull. Nos. 227–228, pp. 79–88, 8 textfigs.
1903. Professor JAECKEL's Thesis on the Mode of Existence of *Orthoceras* and other Cephalopods, Amer. Geologist, Vol. 31, pp. 199–217.
1921. Observations on the Mode of Life of Primitive Cephalopods, Bull. Geol. Soc. Amer., Vol. 32, pp. 315, 320, 9 textfigs.
RUSSELL, F. S., and YONGE, C. M.
1928. The Seas, pp. 179–185.
SCHUCHERT, C.
1911. The Palaeogeographic and Geologic Significance of Recent Brachiopoda, Bull. Geol. Soc. Amer., Vol. 22, p. 266.
TWENHOFEL, W. H.
1926. Treatise of Sedimentation, p. 136.
YABE, H.
1932. Brachiopods of the Genus *Pictothyris* THOMSON, 1927, Sci. Rep. Tôhoku

Imp. Univ. Sendai, Ser. 2, Geol., Vol. 15, No. 3.

YOKOYAMA, M.

1920. Fossils from the Miura Peninsula and its Immediate North, Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. 39, Art. 6.

1922. Fossils from the Upper Musasino of Kadusa and Simôsa, ibid., Vol. 44, Art. 1.

1923. On Some Fossil Shells from the Island of Saisyû in the Strait of Tusima, ibid., Vol. 44, Art. 7.

1924. Mollusca from the Coral-Bed of Awa, ibid., Vol. 45, Art. 1.

1926. Fossil Shells from Sado, Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. 1, Pt. 8.

1926. Fossil Shells from Atumi Peninsula, ibid., Vol. 1, Pt. 9.

1927. Mollusca from the Upper Musasino of Tôkyô and its Suburbs, Mollusca from the Upper Musasino of Western Simôsa and Southern Musasi, ibid., ibid., Vol. 1, Pt. 10.

1928. Mollusca from the Oil-Field of the Island of Taiwan, Rep. Imp. Geol. Surv. Japan, No. 101.

# Classification and Distribution of Islands of Japan

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The total number of small islands that make up Japan amounts to about 5529, excluding 623 in the mandated territory of the South Sea and 108 of the Kwantung leased territory.

In this paper, only islands smaller than Etorohu (3220 km$^2$) of the Kuriles are considered, the large islands of Honsyû, Sikoku, Kyûsyû and Hokkaidô forming Japan proper, and Formosa being treated as mainlands.

| | Number of islands | |
|---|---|---|
| | Circumference above 1 km | Circumference under 1 km |
| Japan proper | 1080 | 2989 |
| Honsyû | 382 | 1027 |
| Sikoku | 167 | 304 |
| Kyûsyû | 373 | 1046 |
| Hokkaidô | 69 | 228 |
| Ryûkyû | 89 | 384 |
| Korea | 1164 | 2315 |
| Formosa | 76 | 223 |
| Saghalin | 2 | 2 |
| Sum | 2324 | 5529 |

At first we can classify the islands into continental and oceanic simply in reference to their distance from the mainland.

Islands of either group are generally in groups, as in Fig. 2.

The following classification of islands is made on geomorphic basis. First of all volcanic-, coral- and non-volcanic islands are genetically distinguished. Types intermediate between these three are the reef-encircled volcanic islands, reef-encircled non-volcanic islands and partially volcanic islands (ordinary islands but with one or more volcanoes on part of the island). Fig. 1 shows the distribution of the islands of these different types.

1) Volcanic Islands. Most of the oceanic islands can be said

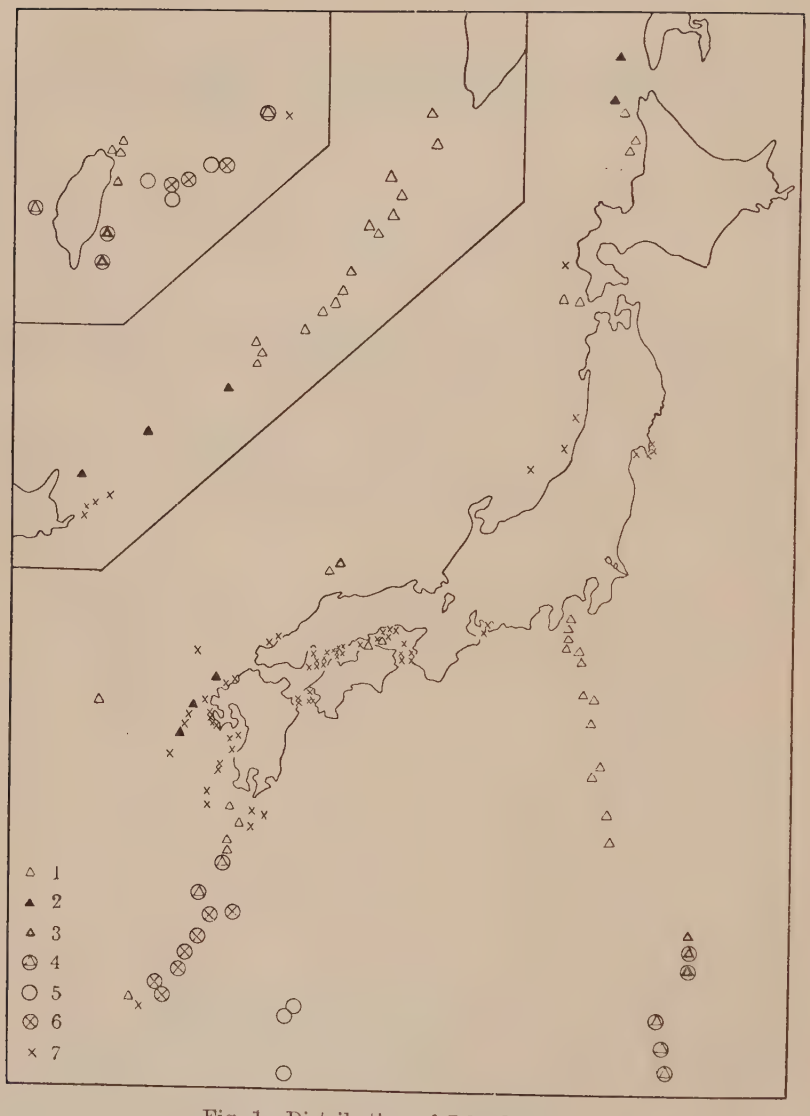


Fig. 1 Distribution of Islands Types

1. Volcanic island 2. Non-volcanic island with volcano 3. Island of ancient volcano 4. Reef-encircled volcanic island 5. Coral island 6. Reef-encircled non-volcanic island 7. Non-volcanic island

to be volcanic, and they have always a linear arrangement, viz. in arc or chain. Each volcanic islands in an arc, it seems, are separated from each other in a certain distance. In form they are generally

conical and in stage of erosion very young. "Tholoide" islands are rare, the only examples being Unisiru North Is., and Tirihoi South Is., both in the Tisima arc, and Uturyô-tô in Korea.

"Aspite" islands are lacking in Japan proper, but one (Saisyû-tô) in its dependent isles, Hiyô-tô. On the contrary, several "pedionite" islands are in the Hôko group (G in Fig. 2) and in the $B_2$. Sikinezima of the Izu chain ($C_1$) is also of this type. The limit may exist in the size of one cone, but not in the compound ones as Etorohu or Kunasiri in the Tisima arc. Some of them have many volcanoes, as Paromusiru in the same arc, which is composed of a young conide, an "aspite", ten "tholoide" and a maturely dissected "conide".

Abrasion and erosion begins with the naissance of the volcanic island, and if the island body is small, the sea cliff may grow very rapidly and only the rock chimney may remain as Smith, Lot's Wife, Bayonnaise Rocks as in the Zunan arc. Oftenly volcanic island suffer upheaval or submergence or even both alternately. Three large islands near Hokkaidô, Etorohu, Kunasiri, Uruppu, and Rebun, Risiri on the western sea of Hokkaidô, have marine terraces; while the middle island of the Sulphur group, and Aguni and Kume in the Ryûkyû arc are capped or fringed by elevated reefs.

Volcanic islands in the coral sea are ordinarily fringed by living coral reefs, but the highly cliffed islands are reefless, in contrast to those with embayed coast. There are ancient volcanoes of submarine origin, as the Bonin group or four islands along the east coast of Formosa. The Oki islands are also the same, but bear new tholoides on them.

2) Coral Islands. Atoll or table reef does not exist in the Japanese seas, while the barrier or fringing reefs are developed as far north as Suwanose in the Ryûkyû arc on the west, and the Bonin chain on the east. Elevated reefs, barrier or fringing, are found on every island of the Ryûkyû arc, except the Ôsumi subgroup near Kyûsyû, and on the Bonin islands, while the Daitô islands are sometimes stated to be elevated atolls.

3) Non-volcanic Islands. Most of them are only the highest portions of the depressed land. They occur generally in groups, but where the submergence was too great, only the eminent summits remain as isolated islands. When the original mountain was maturely dissected and rich in articulations, a later depression in a fairly large amount will produce the so-called skeleton island. Heguri island in

Setouti is a good example. And where the depression is followed by faulting as in Setouti, the island pattern is controlled by the trends of the respective fault scarp submerged. There are also many islands showing traces of recent upheaval; Awazi-sima in Setouti is such a terraced island. A few islands of small size are due to mere abrasion, without participation of crustal movements, while many other islands are land-tied by sand bars, as in the north or northwest coast of Kyûsyû.

Non-volcanic islands are mostly continental in origin and only a few, such as the Suisyô group in the Tisima arc, the Ôsumi group in the Ryûkyû arc and the Kosiki group, are oceanic. Thus the non-volcanic islands capped by volcano are few, exception being the three large ones in the Tisima arc and Rebun island.

We will now describe the topographical features of each island groups.

## Oceanic Island

A) Tisima arc. This arc has about fifty islands, stretching from Nemuro of Hokkaidô to Kamtchatka.

According to Tokuda's view, this arc is composed of many small island chains en échelon, and the larger the distance from Hokkaidô, the greater is the interval between them. But here we classify them into three chains, based on morphological characters. The innermost island ($A_1$) are simple volcanic cones and are in a very young stage of erosion, except Makkaru. Araito and Raikokei volcanoes are still active. Islands at the middle form the main chain, and most of them have two or three volcanoes. The southernmost three are surrounded by several terraces of marine origin, cut into the Tertiary formation. Volcanoes are subject to slight dissection and still retain their conical form. Calderas are found on Onnekotan, Simsiru, Etorohu, and only the former two and Uruppu are tholoides. The outermost Suisyô islands near Nemuro peninsula are small non-volcanic islands and they have complex coast-lines due to the recent submergence.

B) Islands along the Japan Sea coast. Here this name is used for these islands in an arc beginning from Kaiba island in the western side of Saghalin, passing Sado, Oki, Iki and Tusima, ending at Gotô and Ome islands. This arc is divided into three chains, $B_1$ in the northern part of Japan, $B_2$ in the southern part and Tusima islands.

In the $B_1$ chain, Risiri, Osima, and Kosima are considered to be

Fig. 2 Island Group

Oceanic Islands

A Tisima (Kurile) arc: $A_1$ Inner simple volcanic chain, $A_2$ Main chain, $A_3$ Suisyô Ids.

B Islands fringing the Japan Sea Coast: $B_1$ North-east Japan Ids., $B_2$ South-west Japan Ids., $B_3$ Tusima Id.

C Zunan Ids.: $C_1$ Idu chain, $C_2$ Ogasawara (Bonin) chain.

D Kosiki group.

E Ryûkyû (Loochoo) arc: $F_4$ Inner volcanic chain, $E_2$ Main chain, $E_3$ Daitô Ids.

F Islands along the east coast of Formosa.

G Hôko Ids.

H Saisyû-tô Ids.

Continental Islands

a Ozika peninsula, b Matusima bay, c Atumi bay, d Sima peninsula e Kii channel, f Bungo channel, g Nagato dependent Ids., h North coast of Kyûsyû, i North-west coast of Kyûsyû, j Setouti Ids., k Amakusa Ids.

new volcanic islands and Rebun is the young tholoide on the Tertiary base. Most of the islands in this chain may be said to be upheaved islands, and the terrace height attains 1100 m in Sado and 580 m in Okuziri. But a recent small submergence occurred in Sado and Aôsima; the present outline of the former consisting of two blocks linked together is largely due to this process.

The islands of the $B_2$ chain have basement of sedimentary rocks and covered with basaltic lava, and are plateau-like in their forms. This is the case of Iki, Misima, and Gotô Islands. Only the Oki group has overlying lava domes. The submergence topography is general in these islands of the $B_2$ group and the length of embayments sometimes reach to 6 km in Tusima and Iki, and 5 km in Oki and Gotô.

C) Zunan Arc. This arc is composed of Izu, Bonin and Sulphur Ids. and is the southern extension of the Huji volcanic zone. The islands of the Izu chain are all young volcanoes, but abrasion progressed so greatly that some are highly cliffed (Tosima, Mikura-sima). In this chain we can distinguish Ôsima group of andesitic cones from Nii-zima group of liparitic domes.

The islands of Ôsima group are simple in structure, except the twin volcanoes of Hatizyô. They are all young, and Ôsima, Miyake-sima, Aoga-sima and Tori-sima are all now active. In the islands of Nii-zima group, there are two domes underlaid by tuff cones.

The Bonin chain includes old volcanic islands of submarine origin, and there we can see the elevated abrasion platforms (Haha-zima, Muko-zima) and elevated coral reefs of Tertiary age (Titi-zima). Since they have suffered from the later submergence, shorelines are intricate and now fringed by living coral-reefs.

The Sulphur or Volcanic islands are three conides, viz. north, middle and south, and the middle one has besides a cone, a tuff dome, on which an elevated reef exists at the height of 110 m.

D) Kosiki group. This group is the prolonged part of the Kyûsyû mountains and includes Kosiki islands of the Mesozoic formation and Uzi islands and others of geological formations of unknown ages.

E) Ryûkyû arc. This arc was divided into three chains on the view of tectonic, but geographically it can be separated into two, namely inner zone of volcanic cones and the outer row of large islands. The former is the southern extension of Kirisima volcanic zone in Kyûsyû. Except a few, they are mostly fresh cones, but in detail, we can distinguish three phases of volcanic activity among them, active

(Kutinoerabu, Suwanose), extinct (Aguni, Kume) and ancient (Pinnacle Ids.).

The main chain comprises Ôsumi-, Amami-, Okinawa- and Sakisima groups, and these groups are composed of several subgroups. The structure and form of the islands are very complex; there are Tertiary, Mesozoic and Paleozoic formations, and benches of elevated reefs occur side by side with embayments of recent date. Moreover, the islands are surrounded by fringing or barrier reefs.

The Daitô group ($E_3$) which crosses obliquely the above mentioned two chains has three small islands; these are all elevated atolls and have living barrier reefs.

F) Islands along the east coast of Formosa. These volcanic islands have been elaborately carved by erosion and upheaved afterwards.

G) Hôko group. This group has 54 islands in five subgroups, excluding those smaller than 100 m in length. These are mesas of successive basalt flows; the uppermost bed is 5 or 6 m thick, having fine columnar joints, the middle one is porous and the lowest lies below sea level.

H) Saisyû-tô group. The giantic shield volcano of Saisyûto and its dependant small isles (26) make up this group. The main island has many parasitic cones, numbering 360 or more.

Apart from the oceanic islands in groups, there are a few isolated islands. Okino-erabu (136°E, 205°N) and South Tori-sima (145°E, 24°14′N) are small coral islands and Uturyô-to (130°50′E, 37°30′N) is a volcanic island.

### Continental Islands

a) Around Ozika Peninsula. The submerged southern part of the Kitakami mountainland has small islands as granitic Kinkazan and others of Mesozoic formations with the bench corresponding to the terrace of 60 m height of the adjacent land.

b) In Matusima Bay hundreds of small islands are enclosed in the depressed rectangular water area governed by two fault systems of NE-SW and NW-SE. These islands are divided into two groups, Matusima and Eboisi group.

c) In Atumi Bay. Scattered small islands in the bay heart are submerged granitic hills. Larger islands at the bay mouth are the extension of Tita peninsula.

d) Around Sima peninsula.

e) In Kii channel.

f) In Bungo channel.

These islands of Mesozoic or Paleozoic formation are formed by the downwarping of the outer zone of southeast Japan, and arranged parallel to the mountain system.

g) Nagato dependent islands.

h) In the north coast of Kyûsyû. Several islands of granite, Paleozoic- and Tertiary rocks have abrasion surfaces (60–70 m), covered with basalt flow. A few of them are land-tied as Siga-sima, Keyazaki and Kane-no-misaki.

i) In the northwest coast of Kyûsyû. Innumerable isles scattered in the sea near Nagasaki, were born as the result of submergence diminishing inclination of the former land surface.

j) Setouti island group. These islands were produced by submergence followed by faulting, in the north of the median line of southwest Japan. This group may be divided into many subgroups (eight or more), and their boundary lines have a definite linear strike of NE-SW or NW-SE, and most of them are believed to be submerged fault scarps. The degree of submergence is different in each subgroup Greater the sinking fewer the islands, and there occur even vacant areas, so-called *nada*. Except the largest island of this group, Awazi, is no traces of upheaval. Most of them is non-volcanic, but there are mesa (Te-sima, Yasima) and several butte islands (Ozuti, Kozuti).

k) Amakusa group. This island group lies in the sea once continued to the Setouti, but now separated from it by the eruption of Also and other volcanoes, and may thus be called the islands of the Setouti type. The recent upheaval is known in this group.

In addition to the above mentioned islands, there are many continental ones along the coasts, but they do not form distinct groups. The details about them and two thousands islands dependent of Korea are put aside from the present consideration.

# Classified List of Papers and Reports bearing on Oceanography Published in Japan during 1936.

(* articles written in Japanese)
(§ articles with resume in foreign language)

Abbreviations for Titles of Periodicals.

| | |
|---|---|
| Ann. Zool. Jap. | Annotations Zoologicae Japonenses. |
| Bot. Mag. | Botanical Magazine (Shokubutsu gaku Zasshi). |
| Bull. Biogeogr. Soc. Jap. | Bulletin of the Biogeographical Society of Japan. |
| Bull. Earthq. | Bulletin of the Earthquake Research Institute, Tokyo Imperial University. |
| Bull. Jap. Soc. Sci. Fisher. | Bulletin of the Japanese Society of Scientific Fisheries. |
| Chikyu | Chikyu (The Globe). |
| Dob. Z. | Dobutugaku Zassi (Zoological Magazine). |
| Ecol. Rev. | Ecological Review. |
| Geogr. Rev. Jap. | Geographical Review of Japan. |
| Hyd. Bull. | Hydrographical Bulletin (Suirô Yôho). |
| Jap. Jour. Astron. | Japanese Journal of Astronomy and Geophysics. |
| Jap. Jour. Genetics | Japanese Journal of Genetics. |
| Jap. Jour. Geol. Geogr. | Japanese Journal of Geology and Geography. |
| Jap. Jour. Limn. | Japanese Journal of Limnology. |
| Jap. Jour. Zool. | Japanese Journal of Zoology. |
| Jour. Geogr. | Journal of Geography. |
| Jour. Geol. Soc. Jap. | Journal of the Geological Society of Japan. |
| Jour. Imp. Fisher. Inst. | Journal of the Imperial Fisheries Institute. |
| Jour. Ocean. | Journal of Oceanography (Kaiyô Zihô). |
| Mem. Coll. Sci. Kyoto Imp. Univ. | Memoirs of the College of Science, Kyoto Imperial University. |
| Proc. Imp. Acad. | Proceedings of the Imperial Academy. |
| Rec. Ocean. Wk. Jap. | Records of Oceanographic Works in Japan. |
| Rep. Civil Eng. Exp. St. | Report of the Civil Engineering Experimental Station (Doboku Sikenzyô Hôkoku). |
| Sci. Papers Algol. Res. Inst. Fac. Sci. Hokkaidô Imp. Univ. | Scientific Papers from the Algological Institute, Faculty of Science, Hokkaidô Imperial University. |

Sci. Rep. Tokyo Bunrika Daig. .....Science Reports of the Tokyo Bunrika Daigaku (College of Literature and Science).

Sci. Rep. Tôhoku Imp. Univ., Ser. 2. ..Science Reports of the Tôhoku Imperial University, Series 2, Geology.

Sci. Rep. Tôhoku Imp. Univ., Ser. 4. ..Science Reports of the Tôhoku Imperial University, Series 4, Biology.

Saito Ho-on Kai Mus. Notes .....Saito Ho-on Kai Museum Notes (Hakubukwan Zihô).

Saito Ho-on Kai Mus., Res. Bull. ....Saito Ho-on Kai Museum Research Bulletin.

Trans. Pal. Soc. Jap. .....Transactions of the Palaeontological Society of Japan.

Trans. Sapporo Nat. Hist. Soc. .....Transactions of the Sapporo Natural History Society.

Venus .....Venus, The Malacological Society of Japan, Kyoto Imperial University.

Zool. Mag. .....Zoological Magazine (Formerly Dobutugaku Zassi).

## Physical and Chemical Oceanography

*Akiyosi, T.: On the dip of sea horizon observed on the sea southward of Honsyû, Japan. Hyd. Bull., No. 6, pp. 223–231, 1 pl.

* ,, : On the visible distance of light on the sea in case there are temperature differences between the air and water. Hyd. Bull., No. 7, pp. 267–276, 3 tables, 4 figs.

Earthquake Research Institute: Relative vertical displacements of bench-marks along the lines of levels from Hukuroi to Okitu, from Okitu to Odawara, and from Okitu to Kôhu. Bull. Earthq., Vol. 14, Pt. 3, pp. 481–485.

,, : Relative displacements of bench-marks along the line of levels from Yugawara to Zyôto-mura, on the east coast of Idu Peninsula. Bull. Earthq., Vol. 14, Pt. 3, pp. 486–488.

Fisheries Experimental Station of the Government General of Tyôsen: Oceanographical charts of the adjacent sea of Tyôsen for the year 1935.

,, : Annual report of hydrographical observations, No. 7, for the year 1932.

*Fukutomi, T.: Heights of Tunamis at Simoda in southern Idu Peninsula. Bull. Earthq., Vol. 14, Pt. 1, pp. 68–74, 5 figs., 1 table, 2 pls.

*Goto, T.: Weekly magnetic observations at Zinsen, Taihoku, Odomoari and Parao in 1934. Hyd. Bull., No. 1, pp. 1–5, 3 figs., 8 tables.

*Hada, Y.: Studies of Bog Lakes. 1, Bog lake of Tokotan, Jap. Jour. Limn., Vol. 6, No. 4, pp. 143–151.

Hasegawa, M.: On the type of diurnal variations of the terrestrial magnetism of quiet days. Proc. Imp. Acad., Vol. 12, No. 4, pp. 88–90.

,, : A statistical study of the type of diurnal variations of terrestrial magnetism on quiet days. Proc. Imp. Acad., Vol. 12, No. 7, pp. 185–188.

Hydrographic Department: Reports on bottle drifts, No. 132–141. Hyd. Bull., January–December.

* ,, : Examples of calculation on finding longitude at sunrise and sunset at sea. Hyd. Bull., No. 10, pp. 393–399.

* ,, : On the decrease of depth at South Chan., Hainan St., and some information available on passing there-through. Hyd.

Bull., No. 10, pp. 407–408.

* „ : The investigation about the range of sound fog for signal. Hyd. Bull., No. 10, pp. 400–405.

* „ : Voyages between the ports on the coast of Japan. Hyd. Bull., No. 9, pp. 369–376.

* „ : Information about the fog on the east coast of Tyôsen. Hyd. Bull., No. 2, pp. 43–49, 1 pl., 2 tables.

* „ : The 1910 to 1935 survey of the currents of the Indian Ocean and China Sea. Hyd. Bull., No. 11, pp. 441–450, 6 figs., 4 tables.

*Imperial Marine Observatory: Report on sea ice (December 1935 to May 1936). Jour. Ocean., Vol. 9, No. 1, pp. 57–72.

* „ : Report of the oceanographical observations in the neighboring seas of New Volcano Island (Iwozima-Sinto) in July 1935. Jour. Ocean., Vol. 9, No. 1, pp. 1–16.

* „ : Report of the limnological observations in "Hime-numa", Risi Island, Hokkaidô. Jour. Ocean., Vol. 9, No. 1, pp. 17–19.

* „ : The temperatures and densities of sea-water along the Japanese coasts (January to April 1936). Jour. Ocean., Vol. 9, No. 1, pp. 19–48.

*Isii, H.: The shoreline migration of Toyama Bay. Geogr. Rev. Jap., Vol. 12, No. 10, pp. 835–869.

Kimura, K.: Hydrographical observations near Awasima Isle situated at the north-eastern end of Suruga bay (Further note II).

„ : Hydrographical observation near Awasima Isle situated at the north-eastern end of Suruga bay (Further note III). Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 374, 10 figs., 5 tables.

„ : Variations of mutual relations among water temperatures, salinity, and transparency. Bull. Jap. Soc. Fisher., Vol. 4, No. 5, p. 339, 7 figs., 5 tables.

*Konno, Y.: Nigori-gawa, an acid stream originated from the crater-lake "Okama", of Mt. Zawô. Jap. Jour. Limn., Vol. 6, No. 1, pp. 21–26.

*Kubo, T.: Annual change of sea-water temperature in the Kôbe harbour. Jour. Ocean., Vol. 9, No. 1, pp. 73–75.

Kume, T.: On the saturation of non-volatile substances in aqueous solutions. Proc. Imp. Acad., Vol. 12, No. 6, pp. 164–166.

*Masiko, K.: Measurement of the light intensity penetrated into waters

off Asamusi, and at lake Osoresan by means of hydiodic acid. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 189–191, 2 tables, 1 fig.

*Matudaira, Y.: Report on the surface observations along the routes of the cruise of the training ship "Shintoku Maru". Jour. Ocean., Vol. 9, No. 1, pp. 81–96.

*Matsuo, H., and Homma, H.: Experiments on the tidal currents at the entrance of Urado bay (2nd report). Rep. Civil Eng. Exp. Station (Doboko Sikenzyô Hôkoku), Vol. 35, No. 3, pp. 39–46, 21 figs.

Matuyama, M.: Distribution of gravity over the Nippon Trench and related areas. Proc. Imp. Acad., Vol. 12, No. 4, pp. 93–95, 1 fig.

*Mori, S.: Diurnal change of water-temperature, pH and dissolved oxygen in the water of the littoral region of lake Biwa, Japan. Jap. Jour. Limn., Vol. 6, No. 2, pp. 85–88.

* „ : Coastal feature and landscape of Nagasaki-ken. Chikyu, Vol. 25, No. 2, pp. 130–152, 6 figs.

*Murata, T.: Geomorphological investigations on the Midare-gawa fans, Yamagata prefecture (7th report on alluvial fans). Geogr. Rev. Jap., Vol. 12, No. 11, pp. 1021–1044, 10 pls., 8 figs.

*Niino, H.: On soundings at Musasi-tai. Geogr., Rev. Jap., Vol. 12, No. 2, pp. 85–90.

* „ : Exposure of sedimentary rocks in the sea bottom off Sikoku and Ôsumi strait along the Pacific coast of Japan. Geogr., Rev. Jap., Vol. 12, No. 9, pp. 814–827, 2 figs., 2 tables, 3 pls.

*Nishio, K.: Geological consideration of sinking of earth surface in Tokyo district. Jour. Geogr., Vol. 48, No. 572, pp. 543–472.

*Ogura, S.: Further notes on the tides and tidal currents in the northern part of the Hwang-Hai (Yellow Sea). Hyd. Bull., No. 9, pp. 351–368.

* „ : On the tides and tidal currents in Pwok Hai (No. 1). Hyd. Bull., No. 4, pp. 147–158, 5 pls., 6 tables.

* „ : On the tides and tidal currents in Pwok Hai (No. 2). Hyd. Bull., No. 5, pp. 181–194, 14 pls.

Okada, M.: A method of evaluating stream function for ocean currents. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 80–84, 1 table, 3 figs.

Sezawa, K.: On the relation between seismic origins and radiated waves. Bull. Earthq., Vol. 14, Pt. 2, pp. 149–156.

Sezawa, K., and Kanai, K.: The nature of transverse waves transmitted through a discontinuous layers. Bull. Earthq., Vol. 14, Pt. 2, pp. 157–163.

„ „ : Damped free oscillation and amplitude in resonance, with special reference to decay in seiches in straits. Bull. Earthq., Vol. 14, Pt. 1, pp. 1–9, 9 figs.

„ „ : Damping in seismic vibrations of a surface layer due to an obliquely incident disturbance. Bull. Earthq., Vol. 14, Pt. 3, pp. 354–359.

„ „ : Dissipation waves accompanying forced seiches in a bay. Bull. Earthq., Vol. 14, Pt. 3, pp. 360–366.

*Sugawara, K.: Studies on the freshly participated deposits in lake Takasuka-numa. Jap. Jour. Limn., Vol. 6, No. 3, pp. 102–116.

* „ : The decrease of water density at the bottom of lake Takasuka-numa and temperature measurement. Jap. Jour. Limn., Vol. 6, No. 3, pp. 136–138.

* „ : The decreasing action of dissolved gases on the density of lake waters. Jap. Jour. Limn., Vol. 6, No. 3, pp. 95–101.

* „ : The density of lake water and its decrease at the bottom. Jap. Jour. Limn., Vol. 6, No. 1, pp. 1–10.

Takenouti, Y.: Effects of obstacles upon the submarine illuminations. 1, the rectangular membrane immersed in water. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 224–226, 2 figs., 1 table.

„ : Solar radiation in lake waters. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 149–154, 3 figs., 3 tables.

*Toyohara, G.: Geophysical observations in the mandated South Sea Islands(1). Jour. Geogr., Vol. 48, No. 564, pp. 53–66, 1 map., 15 figs., 4 tables.

* „ : Geophysical observations in the mandated South Sea Islands(2). Jour. Geogr., Vol. 48, No. 565, pp. 135–142, 2 tables, 3 figs.

* „ : A study on underground water of the sea coast (an experiment at Yumigahama, Tottori prefecture). Jour. Geogr., Vol. 48, No. 569, pp. 309–331.

* „ : Oceanographical observations between Yokohama and Jaluit. Chikyu, Vol. 25, No. 5, pp. 243–260.

Uda, M.: Distribution of drifting bodies in the ocean current. Bull.

Jap. Soc. Sci. Fisher., Vol. 4, No. 5, pp. 289–293, 1 fig.

Ueno, M.: Productivity of an extremely eutrophic lake in middle Japan. Proc. Imp. Acad., Vol. 12, No. 8, pp. 248–250.

* ,, : Preliminary survey on the second limnological expedition to Formosa. Jap. Jour. Limn., Vol. 6, No. 1, pp. 33–47, 3 figs., 8 tables.

*Yamada, M.: Inland waters near Siwobara. Jap. Jour. Limn., Vol. 6, No. 3, pp. 116–128.

*Yasui, Z.: Topographical and geographical elements of Iso-no-Umi and Mikawa-wan. Jour. Ocean., Vol. 9, No. 1, pp. 75–80.

*Yazima, N.: Studies on the underground water of the Akiru basin. Jap. Jour. Limn., Vol. 6, No. 4, pp. 169–177.

Yoshimura, S.: Limnology of lake Wakuike, Nagano prefecture, Japan. Proc. Imp. Acad., Vol. 12, No. 8, pp. 245–247.

,, : A contribution to the knowledge of deep water temperatures of Japanese lakes. Jap. Jour. Astron., Vol. 13, No. 2, pp. 61–120, 23 tables, 18 figs.

* ,, : Chemical composition of the lake waters (Inland waters of Formosa 11). Jap. Jour. Limn., Vol. 6, No. 1, pp. 27–32.

* ,, : Oceanographical observations of Simoda bay, Izu Peninsula. Sci. Rep. Tokyo Bunrika Daig., Sec. B, Vol. 1, No. 3, pp. 127–155, 20 figs., 5 tables.

,, and Miyadi, O.: Limnological observations on two crater lakes of Miyake Islands, western north Pacific. Jap. Jour. Geol. Geogr., Vol. 13, pp. 339–352.

* ,, and Yamamoto, S.: Underground water of the Simosa upland in the vicinity of the city of Tiba. Jap. Jour. Limn., Vol. 6, No. 2, pp. 74–84.

## Fundamental Marine Biology

Abe, K.: Kernphasenwechsel von heterochordaria abietina. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 2, pp. 239–242, 2 pls.

*Abe, N.: Ecological observations on *Melarphe* (*Littorinopsis*) *scabra* (Linnaeus), mainly on its locomotion. Ecol. Rev., Vol. 2, No. 1, pp. 35–42, 2 tables, 4 figs.

* ,, : Ecological observations on *Melarphe* (*Littorinopsis*) *scabra* (Linnaeus), mainly on its locomotion. Ecol. Rev., Vol. 2, No.

2, pp. 132–136, 2 figs.

Abe, T. H.: Report of the Biological Survey of Mutsu Bay. 29, Notes on the protozoan fauna of Mutsu bay, (2) Genus *Peridinium,* subgenus *Archaeperidinium.* Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 10, No. 4, pp. 659–686, 102 figs.

,, : Report of the Biological Survey of Mutsu Bay. 30, Notes on the protozoan fauna of Mutsu bay (3), Subgenus *Protoperidinium;* Genus *Peridinium.* Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 1, pp. 18–48, 50 figs.

* ,, : *Diplopsalis* and its allied species. Zool. Mag., Vol. 48, Nos. 8–10, pp. 747–752.

*Aikawa, H.: The planktonological properties of the principal sea areas surrounding Japan. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 33–41, 8 tables.

,, : On the diatom communities in the waters surrounding Japan. Rec. Ocean. Wk. Jap., Vol. 8, No. 1, pp. 1–160, 60 figs., 61 tables.

Asano, K.: New foraminifera from the Kakegawa district, Tôtômi, Japan. Jap. Jour. Geol. Geogr., Vol. 13, pp. 325–332, 2 pls.

,, : Foraminifera from Kuromatunai-mura, Suttu-gun, Hokkaidô. Jour. Geol. Soc. Jap., Vol. 43, No. 515, pp. 615–662, 2 pls.

,, : New species of foraminifera from Aki-gun, Tosa province, Japan. Trans. Pal. Soc. Jap., No. 25, pp. 942–945, 2 pls.

,, : Foraminifera from Muraoka-mura, Kamakura-gôri, Kanagawa prefecture. Jour. Geol. Soc. Jap., Vol. 43, No. 515, pp. 603–613, 2 pls.

,, : *Pseudononion,* a new genus of foraminifera from Muraoka-mura, Kamakura-gôri, Kanagawa prefecture. Trans. Pal. Soc. Jap., No. 15, pp. 347–348, 3 figs.

* ,, : Fossil foraminifera from the Kanagawa district, Tôtômi. Jour. Geol. Soc. Jap., Vol. 43, No. 517, pp. 739–757.

*Asano, N.: Vernacular names of some shells of Oreai Is., Caroline group. Venus, Vol. 6, No. 4, pp. 254–256.

* ,, : On the spawning behavior of the jumping fish, *Periophthalmus* sp. Ecol. Rev., Vol. 2, No. 2, pp. 137–139, 7 figs., 2 tables.

Baba, K.: Opisthobranchia of the Ryûkyû (Okinawa Islands). Jour. Dept. Agri., Kyûsyû Imp. Univ., Vol. 5, No. 1, pp. 1–49, 3 pls.,

26 figs.

*Fukui, T., and Morisita, T.: Three new species of *Acanthocephala* from Japan. Zool. Mag., Vol. 48, Nos. 8–10, pp. 759–764.

*Hada, Y.: Studies on the foraminifera of brackish waters. 1, Hijirippu and Mochirippu lakes. Zool. Mag., Vol. 48, Nos. 8–10, pp. 847–860.

Hamai, I.: Relative growth in some bivalves. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 10, No. 4, pp. 753–765, 6 figs.

*Hanaoka, T.: On Limicolae found in the vicinity of Sumiyoshi-ura, the coast of Osaka bay, Japan. Zool. Mag., Vol. 48, No. 5, pp. 245–257.

Hatai, K.: The geographic distribution of brachiopoda (1) recent brachiopoda of Japan. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 8, pp. 63–70.

„ : The geographic distribution of brachiopoda (2) recent brachiopoda of foreign countries. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 10, pp. 75–90.

„ : A note on the distribution of certain species of marine invertebrates. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 12, pp. 123–141.

„ : A note on a recent brachiopod, *Frenulina sanguinolenta* (Gmelin), with remarks on the subfamily Dallininae Beecher. Venus, Vol. 6, No. 1, pp. 1–14, 2 pls., 9 figs.

„ : A list of brachiopoda dredged by the surveying ship Sitito-maru of the Tokyo Fisheries Experimental Station in August 1935. Bull. Biogeogr. Soc. Japan., Vol. 6, No. 13, pp. 132–146.

„ : A list of the recent brachiopoda dredged from the littoral sea of the Pacific side of Bôsô Peninsula, Central Japan. Rec. Ocean. Wk. Jap., Vol. 8, No. 1, pp. 1–17, 4 figs.

„ : A note on a brachiopod, *Tegulorhynchia döderleini* (Davidson). Venus, Vol. 6, No. 2, pp. 96–104.

„ : A list of the brachiopoda dredged by the Hukui-maru from Wakasa bay, Hukui prefecture, Japan. Venus, Vol. 6, No. 3, pp. 146–154, 1 pl.

„ : On some fossil mollusca from Hukusima prefecture. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 19, pp. 193–196.

„ : Neogene brachiopoda from Japan. Jap. Jour. Geol. Geogr., Vol. 13, pp. 283–325, 2 pls.

,, : Remarks on the loop of certain brachiopoda. Saito Ho-on Kai Mus., Res. Bull. No. 10, pp. 219–229, 41 figs.

,, : Fossil brachiopoda from the Ninohe district, Mutu province. Jap. Jour. Geol. Geogr., Vol. 13, pp. 71–84, 1 pl.

,, : A synopsis of the recent and fossil rhynchonellid brachiopoda. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 20, pp. 197–205.

*Hatakeda, W.: Vernacular names of shells in Shodoshima. Venus, Vol. 6, No. 2, pp. 114–118.

Hayasaka, I.: A twinned or double fossil shell of *Rotalia*. Trans. Pal. Soc. Jap., No. 7, pp. 60–62, 3 figs.

*Hirase, S.: On two new Opisthobranchiata from Japan. Zool. Mag., Vol. 48, Nos. 8–10, pp. 731–736.

*Hiro, F.: Notes on the molluscan fauna of Palao. 1, Common shells and their habitats. Venus, Vol. 6, No. 1, pp. 31–43, 1 fig.

* ,, : Notes on the molluscan fauna of Palao. 11, Molluscs inhabiting on the outer reef and lagoon. Venus, Vol. 6, No. 4, pp. 208–220, 2 figs.

,, : On the geographical distribution of *Ibla*, a littoral cirriped. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 22.

,, : Descriptions of three new species of cirripeds from Japan. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 23.

,, : Report on the cirripedia collected in the Malayan waters by the ship "Zuiho-maru". Jap. Jour. Zool., Vol. 6, No. 4, pp. 621–636, 9 figs.

* ,, : Synbiotic relation between thoracic cirripedia and other animals. Ecol. Rev., Vol. 2, No. 1, pp. 58–65, 1 table.

,, : Occurrence of the cirriped *Stomatolepas elegans* on a loggerhead turtle found at Seto. Ann. Zool. Jap., Vol. 15, No. 3, pp. 312–320, 5 figs.

Huzimoto, H., and Nagasima, O.: A new fossil locality of Eocene foraminifera in the upstream of Taroko-kyô, Taiwan. Jour. Geol. Soc. Jap., Vol. 43, No. 512, pp. 340–342, 1 pl.

Ichikawa, M.: Supernumeray gill in Urodele, *Triturus pyrrhogaster* (Boie). Zool. Mag., Vol. 48, No. 11, pp. 954–955, 3 figs.

Li, N.: Studies on Japanese Mysidacea. 11, Descriptions of three new species belonging to two new genera, *Parastilomysis* and *Paracanthomysis*. Jap. Jour. Zool., Vol. 7, No. 1, pp. 1–15, 41 figs.

,, : Studies on Japanese Mysidacea. 1, Description of new

and some already known species belonging to the genera *Neomysis, Acanthomysis* and *Proneomysis*. Jap. Jour. Zool., Vol. 6, No. 4, pp. 577–619, 116 figs.

§Ikebe, N.: Pleistocene shell bed of Toyonari, Tiba prefecture, with descriptions of two new species of *Odostomia* and a note on *Arcopagia* (*Merisca*) *serricostata* (Tokunaga). Venus, Vol. 6, No. 4, pp. 189–204, 8 figs.

* ,, : Shell bed of Oyaru, Tiba prefecture. Chikyu, Vol. 26, No. 4, pp. 231–236.

*Ikeda, H.: Fresh-water fishes of Aomori-ken. Hakubutugaku Zassi, Vol. 34, No. 59, pp. 1–6.

,, : Preliminary note on a new family of the Cidaroidea. Ann. Zool. Jap., Vol. 15, No. 1, pp. 486–493.

Ishida, J.: An enzyme dissolving the fertilization of sea-urchin eggs. Ann. Zool. Jap., Vol. 15, No. 1, pp. 453–459.

,, : Distribution of the digestive enzymes in the digestive system of stomachless fishes. Ann. Zool. Jap., Vol. 15, No. 3, pp. 263–284, 13 tables, 7 figs.

,, : Disgestive enzymes of *Actinia mesombranthemum*. Ann. Zool. Jap., Vol. 15, No. 3, pp. 285–305, 17 tables, 6 figs.

Ishijima, W.: On the classification and phylogenetic relation of genera of the Melobesiae. Trans. Pal. Soc. Jap., No. 24, pp. 938–941.

*Ishii, N.: Some new extoparsitic Trematodes of marine fishes. Zool. Mag., Vol. 48, Nos. 8–10, pp. 781–790.

*Ishiki, J.: Sex-changes in two Japanese species of *Crepidula*. Zool. Mag., Vol. 48, No. 1, pp. 6–12, 3 tables.

Kamohara, T.: Supplementary note on the fishes collected in the vicinity of Kochi.(8). Zool., Mag., Vol. 48, No. 1, pp. 17–22, 5 figs.

§ ,, : Supplementary note on the fishes collected in the vicinity of Kochi.(10). Zool. Mag., Vol. 48, No. 11, pp. 929–935, 4 figs.

,, : A review of the peristedidioid fishes found in the waters of Japan. Ann. Zool. Jap., Vol. 15, No. 1, pp. 436–445.

,, : Two new deep-sea fishes from Japan. Ann. Zool. Jap., Vol. 15, No. 1, pp. 446–448.

* ,, : On a new fish of the Triglidae from Kochi. Zool. Mag., Vol. 48, Nos. 8–10, pp. 481–483.

* „ : Supplementary note on the fishes collected in the vicinity of Kochi. Zool. Mag., Vol. 48, No. 6, pp. 306–311, 3 figs.

*Kanamaru, T.: A history of Japanese conchology (18). Venus, Vol. 6, No. 2, pp. 162–168.

Kanehara, K.: Neogene shells from south Chosen. Jap. Jour. Geol. Geogr., Vol. 13, pp. 31–38, 1 pl.

*Kanno, R.: On the zoospores of the genus *Hormiscia urospora*. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 171–182, 5 figs.

Kato, K.: A new polyclad turbellarian, *Cryptocelis cmakusaensis* from southern Japan. Jap. Jour. Zool., Vol. 7, No. 1, pp. 17–20, 1 pl., 3 figs.

„ : Notes on *Paraplanocera*. Jap. Jour. Zool., Vol. 7, No. 1, pp. 21–29, 5 figs.

Katsurada, F.: Beiträge zur kenntnis der biologie und der pathogenen bedeutung der Trematoden. Zool. Mag., Vol. 48, Nos. 8–10, pp. 685–691.

Kikuchi, K.: Fresh-water and brackish-water calanoid copepods of Japan with notes on their geographical distribution. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 29.

„ : On a new species of *Diaptomus* from Formosa. Proc. Imp. Acad., Vol. 12, No. 7, pp. 198–200, 6 figs.

Kimura, K.: A new coefficient of association between two attributes. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 146–148, 4 tables.

Koizumi, T., and Hosoi, K.: On the inorganic composition of the medusae: *Aequorea coerulescens* (Brandt), *Dactylometra pacifica* Goette and *Cyanea capillata* Eschscholtz. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 10, No. 4, pp. 709–721, 6 tables.

Komai, T.: On another form of *Stephanoscyphus* found in the waters of Japan. Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Vol. 11, No. 3, pp. 175–183.

„ : The nervous system in some coelenterate types. 1, *Coeloplana*. Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Vol. 11, No. 3, pp. 158–191.

* „ : On the peculiar scyphopolyp, *Stephanoscyphus*. Zool. Mag., Vol. 48, Nos. 8–10, pp. 535–544.

*Kondo, K.: *Cladocera* of lake Tohutu of the Island of Kunasiri (Kuriles). Jap. Jour. Limn., Vol. 6, No. 4, pp. 152–154.

Kubo, I.: New decapod crustacean from Japan, *Paramja kominatoensis*, gen. et. sp. nov. Bull. Jap. Soc. Sci. Fisher., Vol. 4,

No. 6, pp. 361–364, 2 figs.

,, : A description of a new alpheoid shrimp from Japan. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 43–46, 1 pl.

,, : Two new littoral macrurous crustaceans from Japan. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 47–54, 2 pls.

,, : On Japanese penaeid crustaceans belonging to the genus *Parapenaeopsis,* with a description of one new species. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 55–61, 1 pl., 2 tables.

,, : A new homoloid crab from Japan. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 63–68, 1 pl., 1 table.

§Kudo, T., and Morita, S.: Das vitamin-C in der nervenzelle. Zool. Mag., Vol. 48, No. 11, pp. 917–925, 5 figs. 1 table.

*Kuroda, T.: A recent *Pleurotomaria* new to the Japanese fauna. Venus, Vol. 6, No. 4, pp. 250–253, 3 figs.

* ,, : Conchological news, with preliminary notes on new species. Venus, Vol. 6, No. 4, pp. 239–249.

* ,, : A narrative of the collecting trip in southern Kyûsyû. Venus, Vol. 6, No. 1, pp. 63–72, 2 figs.

* ,, : A list of the Buccinidae of northern Japan. Venus, Vol. 6, No. 3, pp. 175–187.

* ,, : Conchological news, with preliminary notes on new species. Venus, Vol. 6, No. 3, pp. 169–174.

*Kuroda, T.: On bacteriological analysis of the Japanese bloody clam, *Anadara inflata* (Reeve). Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 187–188, 1 table.

Makiyama, J.: The Meisen Miocene of north Korea. Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Vol. 11, No. 4, Art. 8, pp. 193–228, 2 pls., 2 figs.

,, : *Sinanodelphis izumidaensis,* a new Miocene dolphin from Japan. Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Vol. 11, No. 2, pp. 115–134, 3 pls.

Matsubara, K.: On two new species of fishes found in Japan. Ann. Zool. Jap., Vol. 15, No. 3, pp. 355–360, 3 figs.

,, : A new ophidioid fish found in Japan. Zool. Mag., Vol. 48, No. 7, pp. 382–384, 1 fig.

,, : A new and rare ophidiod fish from Japan. Jour. Imp. Fisher. Inst., Vol. 31, No 2, pp. 115–118, 1 fig.

,, : A new bramid fish found in Japan. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, pp. 297–299, 1 fig.

„ : Studies on the scorpaenid fishes of Japan. 111, On the external and internal characters of *Sebastichthys longispinis* Mihi and *Sebastichthys brevispinis* nom. nov., compared. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 79–96, 2 tables, 6 figs.

„ : Biometry of two species of Japanese cardinal-fishes, with special reference to their taxonomy. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 119–130, 6 figs.

„ : Studies on the deep-sea fishes of Japan. 1, On a new apodal fish, *Dysomma japonicus*, with an emendation of the genus *Dysomma*. Zool. Mag., Vol. 48, No. 11, pp. 960–961, 1 fig.

„ : Studies on the deep-sea fishes of Japan. 2, On a new fish belonging to Heteromi. Zool. Mag., Vol. 48, No. 11, pp. 963–964, 1 fig.

„ : A review of two genera of the Japanese sculpins, *Ereunias* and *Marukawichthys* with special reference to their systematic positions. Jour. Imp. Fisher. Inst., Vol. 31, No. 2, pp. 97–114, 8 figs.

*Matsumoto, H.: Upper Miocene invertebrates from Kumanodo, Natori district, province of Rikuzen. Zool. Mag., Vol. 48, Nos. 8–10, pp. 475–480.

Miyake, S.: Reports of the brachyura of Riukiu Islands collected by the Yaeyama expedition during the years 1932–1934. 1, Notes on a new and some rare crabs from Iriomote-shima. Ann. Zool. Jap., Vol. 15, No. 1, pp. 494–505.

„ : Reports of the brachyura of Riukiu Islands collected by the Yaeyama expedition during the years 1932–1934. 11, A list of the known species of the brachyura from Isigaki-shima. Ann. Zool. Jap., Vol. 15, No. 1, pp. 506–513.

„ : On three crabs from off Tori-shima, Danjo-group, Japan. Ann. Zool., Jap., Vol. 15, No. 3, pp. 416–420, 1 pl., 2 figs.

§Miyazaki, I.: On the development of bivalves belonging to the genus *Corbicula*. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 249–254, 3 figs. 2 tables.

*Mori, S.: Biological investigation of inland waters of Sikoku, especially Tokusima prefecture. 1, Potomaplankton of the Yosino river. Jap. Jour. Limn., Vol. 6, No. 4, pp. 155–162.

§ „ : Some ecological observations on the fresh-water snail,

*Melanoides* (*Semisulcospira*) *libertinus* (Gould). Venus, Vol. 6, No. 4, pp. 221–231.

*Motomura, I.: Notes on the cytoplasmis structure of the egg of a sea-urchin, *Strongylocentrotus pulcherrimus* (A. Agassiz). Zool. Mag., Vol. 48, Nos. 8–10, pp. 753–758.

Narita, S.: Two new marine algae from Japan sea. Bot. Mag., Vol. 50, No. 595, pp. 386–389, 4 figs.

*Negoro, K.: Planktoncynophyceen in japanische seen und teichen 1. Jap. Jour. Limn., Vol. 6, No. 4, pp. 163–168.

Niino, H.: Newly discovered *Thyasira bisecta* Conrad var. *nipponica* Yabe et Nomura from the sea bottom of north of Tobishima. Jour. Geogr., Vol. 48, No. 567, pp. 202–205, 1 fig., 1 pl.

* „ : Two examples of holes bored by bivalves. Jour. Geol. Soc. Jap., Vol. 43, No. 511, pp. 239–241, 1 fig.

* „ : *Pecten*(*Patinopecten*) *tokyoensis* Tokunaga discovered in sediments of continental shelf in southwestern Japan. Jour. Geogr., Vol. 48, No. 570, pp. 359–362, 2 pls., 2 tables, 1 fig.

Nisiyama, S.: On the occurrence of *Temnotrema rubrum* in the Pleistocene of Turumi, Kwanto region. Jour. Geol. Soc. Jap., Vol. 43, No. 509, pp. 122–128, 1 pl.

Nojima, S.: On a new species of *Liparis*. Trans. Sapporo Nat. Hist. Soc., Vol. 14, Pt. 3, pp. 178–180, 1 fig.

Nomura, S.: A new species of the genus *Septifer* from Japan. Venus. Vol. 6, No. 4, pp. 205–208, 12 figs.

„ : Pyramidellidae from Siogama bay, northeast Honsyû, Japan. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 1–108, 12 pls.

Nomura, S., and Hatai, K.: On the occurrence of a peculiar shaped concretion probably due to certain decapod crustacean. Jap. Jour. Geol. Geogr., Vol. 13, pp. 57–62, 1 pl.

„ „ : On some species of the genus *Arca* from the Neogene of Northeast Honsyû, Japan. Jap. Jour. Geol. Geogr., Vol. 13, pp. 71–84, 2 pls.

„ „ : A note on the fossil marine fauna from Okinawa-zima, Ryûkyû Group. Trans. Pal. Soc. Jap., No. 12, pp. 336–339.

„ „ : A note on some fossil mollusca from Tugaru Peninsula, Northeast Japan. Jap. Jour. Geol. Geogr., Vol. 13, pp. 277–282, 1 pl.

„ „ : On the geographical distribution of certain shell-bearing mollusca and their geologic significance. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 195–208.

„ „ : On some fossil brachiopoda from Akita prefecture, Northeast Honsyû, Japan. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 183–194, 1 pl.

„ „ : Fossils from Yazawagi-mura, Ugo province, Northeast Honsyû, Japan. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 157–181, 1 pl.

„ „ : Fossils from the Tanagura beds in the vicinity of the town Tanagura, Hukusima-ken, Northeast Honsyû, Japan. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 109–155, 5 pls.

„ „ : A note concerning the data on the bathymetric range of certain marine animals and remarks on the geology of the Neogene formations in northeast Honsyû, Japan and their depth of sedimentation as indicated by the fossil fauna. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 231–334.

„ „ : Palaeontologic notes. Part 1, A note on *Coptothyris grayi* (Davidson). Part 2, A new species of *Lithophaga* from the Miocene of the Ninohe district, Iwate prefecture. Part 3, A short note on the shells of certain invertebrates. Saito Ho-on Kai Mus., Res. Bull., No. 10, pp. 209–217, 3 figs.

„ „ : *Diestothyris tisimana,* a new species of brachiopoda from the Northern Pacific. Venus, Vol. 6, No. 3, pp. 131–134, 1 pl.

„ „ : A note on the zoological provinces in the Japanese seas. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 21, pp. 207–214, 1 pl.

„ „ : The geologic significance of the recent mollusca from the vicinity of Isinomaki, Rikuzen. Jour. Geol. Soc. Jap., Vol. 43, No. 517, pp. 908–813, 1 pl.

Nomura, S., and Zinbô, N.: Molluscan fossils from the Simaziri beds of Okinawa-zima, Ryûkyû Islands. Sci. Rep. Tôhoku Imp. Univ., Ser. 2, Vol. 18, No. 3, pp. 229–266, 1 pl.

„ „ : Two new species of *Acila* from the Neogene of northeast Honsyû, Japan. Venus, Vol. 6, No. 2, pp. 104–107, 3 figs.

„ „ : Catalogue of the recent marine mollusca from Yamagata-ken. Saito Ho-on Kai Mus. Notes, No. 30, pp. 25–30.

„ „ : Additional fossil mollusca from the Yanagawa beds

in the Hukusima basin, Northeast Honsyû, Japan. Saito Hoon Kai Mus., Res. Bull., No. 10, pp. 335–345, 1 pl.

*Ohshima, H.: A list of Pycnogonida recorded from Japanese and adjacent waters. Zool. Mag., Vol. 48, Nos. 8–10, pp. 861–869.

Ohuye, T.: On the coelomic corpuscles in the body fluid of some invertebrates. 3, the histology of the blood of some Japanese ascidians. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 2, pp. 171–206, 1 pl., 7 figs.

,, : On the coelomic corpuscles in the body fluid of some invertebrates. 3, on the coelomic corpuscles of a holothurid, *Molpadia roretzi* (v. Marenzeller) with reference to those of *Caudina chilensis* (J. Müller). Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 2, pp. 207–222, 12 figs.

,, : On the coelomic corpuscles in the body fluid of some invertebrates. 5, Reaction of the coelomic corpuscles of an echinid, *Temnopleurus hardwickii*(Gray), to vital dyes and some chemical reagents. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 2, pp. 223–230, 6 figs.

,, : On the coelomic corpuscles in the body fluid of some invertebrates. 6, A note on the formed elements in the coelomic fluid of a brachiopod, *Terebratalia coreanica*, Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 2, pp. 231–238, 1 fig., 1 pl.

*Oinomikado, T.: Shell bed of Edogawa park in Tokyo. Chikyu, Vol. 26, No. 5, pp. 334–340.

§ ,, : Conchometrical research on the fossil *Anadara granosa* (Linné), Venus. Vol. 6, No. 3, pp. 135–146, 5 figs., 7 tables.

*Oinomikado, T., Suzuki, K., Sakakura, K., and Ikebe, N.: Shell bed of Hirayama, Tiba prefecture. Chikyu, Vol. 26, No. 4, pp. 237–245.

Okuda, S.: Description of a new sedentary polychaete, *Thoracophelia ezoensis* n. sp. Proc. Imp. Acad., Vol. 12, No. 7, pp. 201–202, 2 figs.

,, : Japanese commensal polynoids. Ann. Zool. Jap., Vol. 15, No. 1, pp. 561–571.

,, : Description of two polychaetous annelids found in the burrows of an apodous holothurian. Ann. Zool. Jap., Vol. 15, No. 3, pp. 410–415, 4 figs.

,, : Polychaetous annelids from Toyama bay and its adjacent waters. 1, Polychaeta sedentaria. Bull. Biogeogr. Soc. Jap.,

Vol. 6, No. 14, pp. 147–157, 8 figs.

Okada, Y., and Ikeda, H.: Notes on the fishes of the Riu-kiu Islands. 1, Chaetodontidae. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 28.

Onoda, K.: Preliminary notes on the experiments of hybridization of some echinoids. Ann. Zool. Jap., Vol. 15, No. 3, pp. 325–329, 2 pls.

,, : Notes on the development of some Japanese echinoids with special reference to the structure of the larval body. Jap. Jour. Zool., Vol. 6, No. 4, pp. 637–654, 5 pls., 9 figs., 1 table.

Otuka, Y.: Pliocene mollusca from Manganzi in Kotomo-mura, Akita prefecture. Trans. Pal. Soc. Jap., No. 21, pp. 56–66, 2 pls.

* ,, : Notes on some shells from southern Taiwan (1). Venus, Vol. 6, No. 3, pp. 155–162, 23 figs.

* ,, : Notes on some shells from southern Taiwan (2). Venus, Vol. 6, No. 4, pp. 232–238, 14 figs.

* ,, : A fossil shell bed at Sinkosinzuka, Sugamo, Tokyo, Jour. Geol. Soc. Jap., Vol. 43, No. 516, pp. 707–708.

,, : The faunal character of the Japanese Pleistocene marine mollusca, as evidence of the climate having become colder during the Pleistocene in Japan. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 16, pp. 165–170, 2 figs.

,, : Marine lower Pleistocene of the central Kwanto plain (an evidence of basin forming force of the Kwanto plain). Bull. Earthq., Vol. 14, Pt. 1, pp. 75–82, 4 figs. (article on paleontology).

*Oya, T., and Takahashi, T.: On the growth accelerating substance in the liver of marine animals. 1. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 192–194, 3 figs.

*Ozaki, M.: The identification of the species of *Oncorhynchus* in the east coast of Kamtchatka. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, pp. 321–324.

Ozaki, Y.: *Flagellotrema convolutum*, n.g.n. sp., a new trematode of the family Gyliauchenidae. Zool. Mag., Vol. 48, No. 11, pp. 951–953, 1 fig.

,, : Two new genera of the tematode family Allocreadiidae. Zool. Mag., Vol. 48, Nos. 8–10, pp. 513–518.

Saki, T.: Report of the brachyura collected by Mr. Hiro at Palao Islands. Sci. Rep. Tokyo Bunrika Daig., Sec. B, No. 37, pp. 155–177.

Sakakura, K.: On *Microporina articulata* (Fabricus) a chilostomatous bryozoa. Trans. Pal. Soc. Jap., No. 11, pp. 259–267, 1 pl.

Sasaki, N.: The fresh-water sponges obtained in northeast Honshu, Japan, Saito Ho-on Kai Mus., Res. Bull. No. 9, pp. 1–30, 4 pls., 8 figs.

Sato, I.: On the chromosomes in spermatogenesis of the scorpion, *Ruthus martensii* Karsch. Zool. Mag., Vol. 48, No. 11, pp. 955–957, 9 figs.

„ : Notes on the chromosomes of *Cacopoides tornieri* (Vogt) and *Bufo raddei* Strauch. Zool. Mag., Vol. 48, No. 11, pp. 958–960, 11 fig.

Sato, S.: Ciliary movement in the gill of an oyster, *Ostrea gigas*, in relation to temperature. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 409, 1 fig.

Segawa, S.: On the marine algae of Susaki, prov. Izu and its vicinity (2). Inst. Algol. Res. Fac. Sci. Hokkaidô Imp. Univ., Vol. 1, No. 2, pp. 175–197, 13 figs.

Shimada, S., and Tanaka, E.: Distribution of inositol in fish. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 305, 2 tables.

Shino, M.: Bopyrids from Misaki. Rec. Ocean. Wk. Jap., Vol. 8, No. 1, pp. 177–190, 6 figs.

„ : Bopyrids from Shimoda and other districts. Rec. Ocean. Wk. Jap., Vol. 8, No. 1, pp. 161–176, 5 figs.

„ : Bopyrids from Tanabe bay (3). Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Vol. 11, No. 3, pp. 157–174.

Suzuki, K., and Ichimura, K.: Molluscan fauna from the raised beach deposits of Tateyama-Hozyô-mati, Tiba prefecture. Trans. Pal. Soc. Jap., No. 20, pp. 80–95, 2 pls.

*Suzuki, K., and Kanehara, K.: On three forms of *Nuculana* from the Pliocene of Japan. Jour. Geol. Soc. Jap., Vol. 43, No. 510, pp. 177–185, 1 pl.

*Suzuki, S.: On the water diminunition of some gastropods to the air. Ecol. Rev., Vol. 2, No. 3, pp. 223–225.

Svetovidov, A. N.: A note on *Lotella maximowiczi* Herzentstein (Pisces, Anacanthini). Ann. Zool. Jap., Vol. 15, No. 1, pp. 433–435.

Takamatsu, M.: The marine algae from Matsushima bay, Miyagi prefecture, Northeastern Honshu, Japan. Saito Ho-on Kai Mus.,

Res. Bull. No. 8, pp. 1–43, 2 pl. 1 fig.

„ : The marine algae from Kinkwazan Island, Miyagi prefecture, Northeastern Honshu, Japan. Saito Ho-on Kai Mus., Res. Bull. No. 8, pp. 45–70, 1 fig.

„ : Sorocarpus aus der Matsushima-bucht, (prov. Miyagi, Japan), auch morphologisch untersucht. Saito Ho-on Kai Mus., Res. Bull. No. 8, pp. 71–99, 9 pls., 6 figs.

Taki, I.: Observations on antophagy in octopus. Ann. Zool. Jap., Vol. 15, No. 3, pp. 352–354, 2 figs.

*Taki, Iw.: A list of the species of Chiton in the collection of the Saito Ho-on Kai Museum. Saito Ho-on Kai Mus. Notes, No. 30, p. 1.

* „ : Miscellaneous notes on shells (7). Venus, Vol. 6, No. 1, pp. 44–55, 1 fig.

*Tamura, T.: Plankton of strongly acid-water of lake Osoresan-ko. Jap. Jour. Limn., Vol. 6, No. 2, pp. 63–73.

Tan, K.: On the shell structure of *Crassatellites faveolatus* (Sow.). Trans. Pal. Soc. Jap., No. 18, pp. 638–642, 1 pl.

Tanaka, O.: On some new species of Copepoda from Sagami bay. Jap. Jour. Zool., Vol. 7, No. 1, pp. 31–36, 6 pls.

Tokioka, T.: Preliminary report on Argulidae found in Japan. Ann. Zool. Jap., Vol. 15, No. 3, pp. 334–341, 1 pl.

Tokunaga, M.: Three marine crane flies from Japan. Ann. Zool. Jap., Vol. 15, No. 1, pp. 460–468.

*Tokunaga, S.: *Desmostylus* found near the town of Yumoto, Fukushima prefecture. Jour. Geogr., Vol. 48, No. 572, pp. 473–484, 3 pls.

Tomiyama, I.: Gobiidae of Japan. Jap. Jour. Zool., Vol. 7, No. 1, pp. 31–112, 44 figs.

*Tsuda, M., and Yamaguchi, H.: On the bottom fauna of the Biwako-canal in Autumn. Jap. Jour. Limn., Vol. 6, No. 1, pp. 11–20, 4 figs., 4 tables.

*Tsukamoto, Y.: On the shell mound at Kudan, Tokyo. Venus, Vol. 6, No. 2, pp. 110–114, 3 figs.

§Uchida, K.: A note on the pelagic postlarval stage of *Antigonia rubescens* (Pisces, Capriformes). Zool. Mag., Vol. 48, No. 11, pp. 935–939, 2 figs.

* „ : Note on two remarkable heterosomatous postlarvae with greatly elongated and branched dorsal ray. Zool. Mag., Vol.

48, Nos. 8–10, pp. 497–501.

§ ,, : On the distinctive characters between the two closely allied species *Hemirhampas sajori* and *H. kurumaeus* (Pisces, Hemirhamphidae). Zool. Mag., Vol. 48, No. 6, pp. 295–306, 8 figs.

Ueno, M.: Crustacea malacostraca collected in the lakes of the Island of Kunasiri. Bull. Biogeogr. Soc. Jap., Vol. 6, No. 27.

,, : Phyllopod crustacea of the Kurile Islands (1). Bull. Biogeogr. Soc. Jap., Vol. 6, No. 25.

,, : Crustacea malacostraca of the Northern Kurile Islands (2). Bull. Biogeogr. Soc. Jap., Vol. 6, No. 26.

,, : Zooplankton of the Sungari river, Manchoukuo. Ann. Zool. Jap., Vol. 15, No. 1, pp. 520–524.

,, : *Cladocera* of lake Ngardok in Babelthaop of the Palau Islands. Ann. Zool. Jap., Vol. 15, No. 1, pp. 514–519.

,, : Zooplankton of lake Taraika and its neighbouring waters, southern Sakhalin. Trans. Sapporo Nat. Hist. Soc., Vol. 14, Pt. 3, pp. 173–178, 1 pl.

§Uno, M.: *Germo germo* (Lacepede) in the waters east of Nozima promontory, Tiba prefecture. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, p. 235, 2 figs., 2 tables.

,, : Age composition of *Theragra chalcogramma* (Pallas). Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 173–174, 1 table, 1 fig.

Urita, T.: Dimensional morphological and zoogeographical study of Japanese crabs of the genus *Telmessus*. Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Vol. 11, No. 1, pp. 69–90, 7 figs.

§Usi, Y., Sukegawa, T., and Matumoto, M.: On the seasonal variation of iodine content of sea-weeds. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 245–246, 1 fig.

*Wakiya, Y.: A review of Salangidae. Zool. Mag., Vol. 48, No. 8–10, pp. 835–845.

Yabe, H., and Eguchi, M.: Deep-water corals from off Owasi, Mie prefecture. Proc. Imp. Acad., Vol. 12, No. 6, pp. 167–168, 3 figs.

Yabe, H., and Ehara, E.: Two new corals from Taiwan (Formosa). Proc. Imp. Acad., Vol. 12, No. 1, pp. 25–27.

Yabe, H., and Hatai, K.: The recent brachiopod fauna of Japan. (3) Notes on the subfamily Laqueinae. Proc. Imp. Acad.,

Vol. 12, No. 2, pp. 44–46, 14 figs.

YABE, H., and SUGIYAMA, T.: Some deep-water corals from the Palao Islands. Proc. Imp. Acad., Vol. 12, No. 10, pp. 345–348.

YABE, H., SUGIYAMA, T., and EGUCHI, M.: Recent reef-building corals from Japan and the South Sea Islands under the Japanese mandate. Spec. Vol. No. 1, Sci. Rep. Tôhoku Imp. Univ., Ser. 2, pp. 1–69, 59 pls.

YAMAGUCHI, S.: Parasitic Copepoda from mollusks of Japan (1). Jap. Jour. Zool., Vol. 7, No. 1, pp. 113–127, 7 pls.

„ : Studies on the helminth fauna of Japan. Part 14, Amphibian trematodes. Jap. Jour. Zool., Vol. 6, No. 4, pp. 551–576, 26 figs.

YOKOYA, Y.: Some rare and new species of decapod crustaceans found in the vicinity of the Misaki marine biological station. Jap. Jour. Zool., Vol. 7, No. 1, pp. 129–146, 10 figs.

*YOSHIDA, H.: On the pelagic larvae and youngs of *Mytilus crassitesta* LISCHKE. Venus, Vol. 6, No. 1, pp. 22–31, 1 pl., 3 figs.

## Fisheries and Fishery Technology

*ANDO, K.: Fishery industry of the Oki Islands. Chikyu, Vol. 25, No. 2, pp. 119–129.

*AONO, H.: Fishing villages of the eastern part of Kii Peninsula viewed from fishing statistics. Jour. Geogr., Vol. 48, No. 568, pp. 258–278, 7 tables.

EBINA, K.: On the growth of *Pagrosomus major* T. & S. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 411, 8 figs.

*FUJIKAWA, K., and NAGANUMA, H.: Chemical composition of sardine, *Sardinia melanostica* (C. & V.), from Tyôsen. 1, Comparative study on dark muscle and white muscle. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 95–97, 5 tables.

*HIROSE, I., and MIYOSI, K.: Relation between the sampling grades of cans and the inspected items. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 103–105, 2 tables, 2 figs.

*INO, T.: Epipode as a taxonomic character of Japanese albones. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 175–176, 1 fig.

*INUKAI, T.: Experiments on release of young salmon from the hatchery directly into sea water. Zool. Mag., Vol. 48, Nos.

8–10, pp. 907–910.

Kamiya, S.: The visible distance of objects immersed in sea-water. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, pp. 365–373, 5 figs.

Kawaguchi, T., Simizu, Z., Tani, S., and Yui, T.: Difference of chemical composition in various parts of canned crab (*Paralithodes camtschatica*). Bull. Jap. Sci. Soc. Fisher., Vol. 4, No. 6, p. 415, 2 tables.

*Kawakami, T.: On the hygroscopicity of fish-meal. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 51–55, 4 figs., 3 tables.

*Kida, T.: On the surface temperature of water in the tunny fishing grounds off Kusiro and Urakawa in summer. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 87–90, 1 fig., 2 tables.

Kimata, M.: Effect of alkali metals and alkali earth upon the growth rate of bacteria and the decomposition of fish muscle. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 1–4, 1 table, 3 figs.

„ : The rates of the decomposition of fish muscle by various kinds of bacteria. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 77–79, 5 figs.

„ : Effect of halogen ions upon the growth rate of bacteria and on the decomposition of fish muscle. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, pp. 294–296, 2 figs.

„ : Effects of hydrogen-ion concentration upon the decomposition of fish muscle by bacteria. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 143–145, 1 fig.

„ : Effects of carbohydrates upon the rates of decomposition of fish muscle by bacteria. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 219–223, 1 table, 2 figs.

*Kobayashi, H.: On the scales of Ayu, *Plecoglossus altivelis* Temminck & Schlegel. Jap. Jour. Limn., Vol. 6, No. 2, pp. 56–63.

Kondo, Y.: Influence of the difference in size of cotton yarns composing the netting cord on the breaking strength and flexibility of the cord. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 315, 1 fig., 1 table.

* „ : Influence of the size of cotton yarns composing netting cords on the strength against repeated blows. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 171–172, 1 fig.

Kubo, I.: Feeding velocity of the eel, *Anguilla japonica* T. & S., in relation to water temperature and other environmental conditions. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 33, 2 tables,

3 figs.

*Kuragami, M., and Kawana, T.: Sun-spots and breeding as well as yield of the herring, *Clupea pallassi* Cuvier and Valenceinnes. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 93–94, 2 figs., 1 table.

*Matsui, Y.: On the genetical studies in carp. Jap. Jour. Genetics, Vol. 12, No. 1, pp. 44–47.

*Matsuura, Y.: Statistical studies on the whale Foetuses. 1, Blue whale and fin whale in the antarctic. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 25–32, 3 tables, 6 figs.

* „ : Breeding habits of the sperm-whale in the adjacent waters of Japan. Zool. Mag., Vol. 48, No. 5, pp. 260–285.

„ : On the *Lesser Roqual* found in the adjacent waters of Japan. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 325, 2 tables, 4 figs.

§Miyamoto, H.: Model experiments on sea fixed nets for fishing amberfish Seriola. 11, Trap nets set on the fishing grounds under strong tidal currents. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 227–234, 4 tables, 5 figs.

* „ : Model experiments on sea fixed nets for fishing amberfish, Seriola. 1, Ettyû keddle net and ordinary keddle nets. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 158–170, 6 tables, 7 figs.

* „ : Model experiments on trawl nets. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 19–24, 4 tables, 5 figs.

„ : The model experiments on sailing trawl net used in Mikawa bay. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 391, 5 figs.

„ : The model experiment on drifter drag net for fishing "Sirauwo" in lake Kasumigaura. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 310, 1 table, 7 figs.

§Miyoshi, K., and Hirose, I.: Relations among the inspected items for cans. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 247–248, 1 table.

*Nagata, Y.: Iodine content in powdered *Laminaria*. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 45–46, 2 tables.

*Okada, M., Yamaguti, K., and Sinoda, M.: Tones emitted by cans at the inspection by tapping. 1, Relation of pitch of the tones to the weight of salmon cans. Bull. Jap. Soc. Sci. Fisher., Vol.

5, No. 1, pp. 47–50, 5 tables, 2 fig.

„ „ „ : Tones emitted by cans on the inspection by tapping. 2, Weight of contents and the tones of salmon cans. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 242–244, 3 figs.

§Okada, Sh.: Breeding habit of a river sculpin, *Cottus pollux* Günther. Zool. Mag., Vol. 48, No. 11, pp. 923–928, 4 tables, 3 figs.

*Okuno, H.: Model experiment on plates to sink an end of a trawl rope below the surface of water or hydrofoil sinker. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 155–157, 2 tables, 3 figs.

*Oya, T., and Hirosawa, H.: The content of ascorbic acid in the marine animals and products. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 195–198, 3 tables.

*Oya, T., and Takei, T.: On the manufacturing process of the sardine fish meal. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 199–201, 2 tables, 1 fig.

*Sugano, S.: Experiments with models of a surface trawl net for fishing salmons. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 12–18, 6 figs.

„ : The model experiments on fixed nets for fishing salmon in Kamchatka. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 397, 4 figs.

„ : Immigration of salmons to a fishing ground on the west coast of Kamtchatka in relation to hydrographic conditions. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 407, 3 figs.

„ : The depth and the distance from shore of the routes of migration of salmons. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 318, 1 table, 1 fig.

Takahashi, T.: Distribution of amino acid in the food stuffs for fish. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 301, 1 table.

*Takahashi, T., and Hirosawa, Y.: On the digestive ferments of *Anguilla japonica* (T. & S.). 1, Proteolytic ferment and its digestive action on the raw and heated fish muscle. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 109–112, 6 figs.

*Tsukano, S., and Nito, K.: Effects of freezing on the thermal conductivity of fish muscles. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 42–44, 1 fig., 1 table.

§Tauti, M.: An estimation of the diminishing rate of stock. Bull. Jap.

Soc. Sci. Fisher., Vol. 5, No. 4, pp. 239–241, 2 tables.

Tauti, M., and Miyosi, K.: On the propagation of fish due to liberating fry in four lakes, Biwako, Kasumigaura, Kitaura and Suwako. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 311, 1 fig., 1 table.

§Tomimatsu, K.: Measuring of the vacuity of full cans by the elastic deflexion of their upper and lower end plates. 2, Pneumatic vacuum tester. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 255–261, 1 table, 6 figs.

* ,, : Measuring the vacuity of full cans by the elastic deflexion of their upper and lower end plates. 2, Finding out of the most adequate and accurate scale of the vacuity for the "Dial vacuum tester". Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 56–71, 4 tables, 10 figs.

*Uchida, T.: Influence of the currents upon the distribution of races and frequency of asexual reproduction in the actinian, *Diadumene luciae*. Zool. Mag., Vol. 48, Nos. 8–10, pp. 895–906.

§Uda, M.: Fishing centre of "Sanma" (*Cololabis saira* (Brevoort)), correlated with the head of Oyasiwo cold current. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 4, pp. 236–238, 2 figs.

,, : An experimental study of "Siwome" or current rip as a train of horizontal vortices. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 1, pp. 5–11, 6 figs.

,, : Locality for fishing centre and shoals of "Katuwo", *Euthynnus vagans* (Lesson), correlated with the contact zone of cold and warm currents. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 6, p. 385, 4 figs.

*Ueda, S.: Studies on the propagation of Gelidium. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 3, pp. 183–186, 3 figs.

*Ueda, S., and Okada, Y.: On the food of the salmonoid fish, Ayu (*Plecoglossus altivelis* Temminck & Schlegel). Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 113–115, 1 table, 1 fig.

*Uno, M.: Drift-net skipper in the north-eastern waters of Japan. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 91–92, 2 tables, 1 fig.

Yamamura, Y.: Chemical study of food-organisms for fish. V, Tyrosine and tryptophane contents. Bull. Jap. Soc. Sci. Fisher., Vol. 4, No. 5, p. 303, 1 table.

* ,, : The composition of fish muscle and rate of decomposition.

Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 98–102, 1 table, 3 figs.

*Yasuda, H.: Change in length and diameter of a netting cord at the breaking. Bull. Jap. Soc. Sci. Fisher., Vol. 5, No. 2, pp. 85–86, 1 table, 2 figs.

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